GASTROENTEROLOGY

ABSTRACTS AND CITATIONS

NATIONAL INSTITUTE OF ARTHRITIS, METABOLISM, AND DIGESTIVE DISEASES

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PREFACE

GASTROENTEROLOGY ABSTRACTS and CITATIONS is a publication of the National Institute of Arthritis, Metabolism and Digestive Diseases. This specialized information medium has been initiated to fill an existing great need in the field of gastroenterology and to assist the Institute in meeting its obligations to foster and support laboratory and clinical research into the nature, causes, and therapy of diseases of the gastrointestinal tract. Publication GASTROENTEROLOGY ABSTRACTS and CITATIONS makes available citations of all current papers relevant to this field from medical journals published throughout the world. Approximately one-third of the citations dealing with the major aspects of gastroenterology have accompanying abstracts.

The issuing of GASTROENTEROLOGY ABSTRACTS and CITATIONS under the auspices of the National Institute of Arthritis, Metabolism, and Digestive Diseases will provide a much needed current awareness tool to scientists and will facilitate greater integration of research and clinical efforts in this field. The number and great diversity of publications in the area of gastroenterology makes it imperative that an appropriate service be available to investigators and practitioners so that they may be apprised of progress with a minimum of delay. Our aim is to provide the readers with a readily systematized compilation of current published work. The publication will provide the greatest usefulness if these interested investigators will contribute their ideas and comments for consideration whenever possible.

GASTROENTEROLOGY ABSTRACTS and CITATIONS is published monthly and includes citations and abstracts from the biomedical world literature as they are currently received. In addition, yearly cumulated subject and author indexes are published.

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NOTE

Journal names are abbreviated according to the list of abbreviations used by *Index Medicus*. For journals not covered by *Index Medicus*, the abbreviations (with some modifications) found in *International Standard ISO833, 1974*, are used. The two-letter state abbreviations are based on the United States Postal Service Code.

LANGUAGE ABBREVIATIONS

Afrikaans	Afr.	Georgian	Geo.	Persian	Per.
Albanian	Alb.	German	Ger.	Polish	Pol.
Arabic	Ara.	Greek	Gre.	Portuguese	Por.
Armenian	Arm.	Hausa	Hau.	Pushto	Pus.
Azerbaijani	Aze.	Hebrew	Heb.	Rumanian	Rum.
Belorussian	Bel.	Hindi	Hin.	Russian	Rus.
Bengali	Ben.	Hungarian	Hun.	Serbian	Ser.
Bulgarian	Bul.	Icelandic	Ice.	Slovak	Slo.
Burmese	Bur.	Indonesian	Ind.	Slovene	Slv.
Chinese	Chi.	Interlingua	Int.	Spanish	Spa.
Croatian	Cro.	Italian	Ita.	Swahili	Swa.
Czechoslovakian	Cze.	Japanese	Jpn.	Swedish	Swe.
Danish	Dan.	Kirghiz	Kir.	Tagalog	Tag.
Dutch	Dut.	Korean	Kor.	Tamil	Tam.
English	Eng.	Latin	Lat.	Telugu	Tel.
Esperanto	Esp.	Latvian	Lav.	Thai	Tha.
Estonian	Est.	Lithuanian	Lit.	Turkish	Tur.
Finnish	Fin.	Marathi	Mar.	Ukranian	Ukr.
Flemish	Fle.	Masai	Mas.	Urdu	Urd.
French	Fre.	Multilingual	Mlt.	Vietnamese	Vie.
Gaelic	Gae.	Norwegian	Nor.	Welsh	Wel.

ABBREVIATIONS USED IN ABSTRACTS

ACTH	adrenocorticotropic hormone	ml, µl	milli-, microliter(s)
ADP	adenosine diphosphate	mm	millimeter(s)
AMP	adenosine monophosphate	mOsm	milliosmolar; milliosmeter(s)
amp	ampere	msec	millisecond(s)
ATP	adenosine triphosphate	mV	millivolt(s)
A	angstrom	min	minute(s)
BSP	sulfobromophthalein	MTD	maximum tolerated dose
C	degrees centigrade	NAD	nicotinamide adenine dinucleotide
cal	calories	NADH	reduced nicotinamide adenine dinucleotide
cc	cubic centimeter		
cm	centimeter(s)	NADP	nicotinamide adenine dinucleotidephosphate
dl	deciliter		
DNA	deoxyribonucleic acid	NADPH	reduced nicotinamide adenine dinucleotidephosphate
ED_{50}	median effective dose(s)		
EDTA	ethylenediamine tetraacetic acid	ng	nanogram (10^{-9})
e.g.	for example	nm	nanometer(s)
EEG	electroencephalogram	Pa	ambient pressure
ESR	erythrocyte sedimentation rate	PAS	periodic acid - Schiff
g	gram(s)	pg	picogram (10^{-12})
µg	microgram(s)	pgEq	picogram equivalent(s)
Hz	Hertz	p.o.	orally
hr	hour(s)	ppb	parts per billion
Ig	immunoglobulin(s)	ppm	parts per million
i.m.	intramuscular	r	Roentgen
i.p.	intraperitoneal	RBC	red blood cells (erythrocytes), red blood count
IU	international unit(s)		
i.v.	intravenous	resp.	respectively
kcal	kilocalorie(s)	RNA	ribonucleic acid
kg	kilogram(s)	s.c.	subcutaneous
K_m	Michaelis constant	sec	second(s)
LD_{50}	median lethal dose(s)	SGOT	serum glutamic-oxalacetic transaminase
LDH	lactic acid dehydrogenase		
m	meter(s)	SGPT	serum glutamic-pyruvic transaminase
M	molar; mole(s)		
mM	millimolar; millimole(s)	U	unit(s)
µM	micromolar; micromole(s)	UV	ultraviolet
ma	milliampere(s)	V	volt
mCi, µCi	milli-, microcurie(s)	WBC	white blood cells (leukocytes), white blood count
mEq	milliequivalent(s)		
mg	milligram(s)	yr	year(s)

PRE-CLINICAL SCIENCES

MORPHOLOGY, CELLULAR STRUCTURE AND HISTOCHEMISTRY

3470 NAFENOPIN-INDUCED PROLIFERATION OF PEROXISOMES IN THE SMALL INTESTINE OF MICE. (Eng.) Psenicnik, M.; Pipan, N. (Medical Faculty Univ., Yu-6100 Ljubljana, Lipiceva 2, Yugoslavia). *Virchows Arch. [Cell Pathol.]* 25(2): 161-169; 1977.

The effect of nafenopin on the epithelial cells of the small intestine was studied in male Albany mice to determine whether the peroxisomal response to the hypolipidemic drug and the accompanying hypolipidemic effects seen in hepatocytes also occur in other tissues. The mice were fed white bread to which nafenopin was added to provide a daily dose of 1.25 g/kg, and, after 17 days, the control and nafenopin-treated groups were sacrificed. The tissues were incubated in alkaline DAB medium. Ultrathin sections of small intestinal tissue were examined by electron microscopy, and morphological differences in the peroxisomes and mitochondria between the controls and the experimental group were quantitated. In the nafenopin-treated group, proliferation of peroxisomes occurred, as indicated by significant increases in volume, surface, and numerical density of these structures compared with controls. No such alterations were found in the mitochondria. These results show that the response of small intestinal epithelial cells to nafenopin is analogous to that produced in hepatocytes by the same drug. Hepatocyte peroxisomes are supposed to be involved in lipid metabolism, and it seems that small intestinal epithelial peroxisomes play a similar role.

3471 VASCULARIZATION OF THE MYENTERIC PLEXUS IN THE SMALL INTESTINE OF THE HOG AND CAT. (Ger.) Stach, W. (Anatomisches Institut des Bereichs Medizin, Wilhelm-Pieck-Universitat, Gertrudenstrasse 9, DDR-25 Rostock, E. Germany). *Acta Anat. (Basel)* 100(1):161-169; 1978.

The anatomy of the vascularization of the myenteric plexus of the small intestine was studied in 3- to 6-week-old piglets and 16- to 20-week-old cats. The ganglia of the myenteric plexus were found to have independent vascularization in the form of periganglionic capillary networks. As to architecture and density, these capillaries are quite different from the intramuscular capillary bed. The terminal arterioles and sphincteric capillaries running into the periganglionic capillary network are innervated by noradrenergic axons as are the arterial trunk and arcade vessels. Together with the periganglionic arteriovenous shunts, this architecture represents favorable prerequisites for a functionally adapted blood supply to the ganglia. The specific arrangement of intramuscular vessels and the myenteric plexus provides for the close topographic and functional relations between the two systems in all cases of change in the shape of the intestinal wall (e.g., contraction, relaxation, and filling).

3472 LYMPHOID FOLLICULAR PATTERN: A NORMAL FEATURE OF THE PEDIATRIC COLON. (Eng.) Laufer, I.; deSa, D. (Hosp. Univ. Pennsylvania, 3400 Spruce St., Philadelphia, PA 19104). *Am. J. Roentgenol.* 130(1):51-55; 1978.

The lymphoid follicular pattern of the colon was examined in 27 patients less than 15 yr old who underwent double contrast enema. Tiny nodular filling defects up to 2 mm in diameter were seen in 12 of these 27 patients. This pattern was particularly common in children under 5 yr of age; filling defects were demonstrated in seven of nine such patients in whom a good double contrast study was achieved. Among 12 patients with diarrhea and/or rectal bleeding, 10 had lymphoid hyperplasia. However, 5 of 15 patients in whom the condition was not demonstrated had the same symptoms. Only one patient, a girl with juvenile polyposis, underwent subsequent hospitalization. Subtotal colectomy was performed because of chronic malnutrition and failure to thrive. In all other patients, the final radiologic diagnosis was a normal colon with lymphoid hyperplasia. Although the above lymphoid follicular pattern of the colon has been termed lymphoid hyperplasia, it is suggested that it represents a normal lymphoid follicular pattern in the pediatric colon. The term lymphoid hyperplasia should be reserved for cases in which the lymphoid follicles are greater than 2 mm in diameter; this will usually represent an abnormal condition in response to infection, allergy, or immunologic disorders. Several conditions may have a radiographic appearance that resembles the lymphoid follicular pattern described above. Occasionally, particularly when familial polyposis is discovered in a young patient, the appearance of it may resemble lymphoid hyperplasia. In such cases, removal of a rectal polyp for histologic examination will establish the diagnosis. True lymphoid hyperplasia is one of the pathologic features of Crohn's disease, and it is not surprising that, in the early stages, mucosal modularity identical to the lymphoid follicular pattern can be seen. However, the patients described here tend to be older, and more advanced disease elsewhere in the gastrointestinal tract usually will provide the clue to the correct diagnosis.

3473 FLUORESCENCE STAINING OF GASTRIC MUCOSA. A STUDY WITH SPECIAL REFERENCE TO PARIETAL CELLS. (Eng.) Stave, R.; Brandtzaeg, P. (Natl. Hosp. Norway, Oslo, Norway). *Scand. J. Gastroenterol.* 12(7):885-891; 1977.

Precise and simple methods for enumeration of parietal cells alone or in combination with other cell types by paired staining were developed. Resected stomachs from patients with partial gastric resection were fixed at 4 C with either paraformaldehyde or 1-ethyl-3(3 dimethyl-amino-propyl)carbodiimide

HCl (CDI). After 24 hr in CDI, small specimens were dehydrated and paraffin embedded. Pieces of rat gastric mucosa were either processed as above or by alcohol fixation and then paraffin embedded. Other pieces were embedded fresh in Cryoform and frozen. Sera from two individuals with high parietal cell antibody titers (1:512) were used as the source of IgG to obtain fluorescein and rhodamine conjugates. Gastrin (G) cells were demonstrated by direct immunofluorescence, whereas parietal cells were demonstrated either directly or indirectly. Staining methods included the use of hematoxylin and eosin with saffron (HES) or hematoxylin, azophloxine, and saffron (HAS). Other sections were stained with PAS followed by eosin at various concentrations. The number of parietal cells in a standardized area unit was counted. Fluorescence visualization of parietal cells using both HES and HAS staining was superior to conventional light microscopy. It enabled recognition of parietal cells in the gastric body mucosa at low magnification. The HES and HAS methods did not satisfactorily visualize antrum parietal cells. The PAS-eosin method successfully demonstrated antrum parietal cells because of the contrasting red background of the pyloric glands. Paired visualization of parietal and G cells in the same tissue section was achieved immunohistochemically. This methodology is a prerequisite for detailed studies of these two cell types in the transitional zone between the gastric body and the pyloric antrum.

3474 PHALLOIDIN INHIBITS THE FORMATION OF A FILAMENTOUS WEB SURROUNDING ENDOCYTOTIC VACUOLES IN LIVER PARENCHYMAL CELLS. (Ger.) Jahn, W. (Abteilung Naturstoff-Chemie, Max-Planck-Institut fur medizinische Forschung, Heidelberg, W. Germany). *Cytobiologie* 15(3):452-462; 1977.

The effect of pretreatment of the isolated rat liver with phalloidin (1.5 mg) 15-20 min before perfusion at increased posthepatic pressure (15 cm of water column) on the formation of a filamentous web around endocytotic vacuoles was studied. Liver perfusion alone caused the formation of endocytotic vacuoles in the liver parenchymal cells, and most of the vacuoles were surrounded by a filamentous web. Small secondary vacuoles were formed during the spontaneous diminution of the vacuolization. The secondary vacuoles, formed from the primary ones, were found exclusively near by well-marked filamentous areas. Pretreatment of the liver with phalloidin prior to perfusion inhibited the formation of the filamentous web around the endocytotic vacuoles. Clusters of small vacuoles, seen after perfusion without phalloidin pretreatment, were not observed after pretreatment. The inhibiting effect of phalloidin on the formation of the filamentous web is most probably due to the fact that the filamentous web consists of F-actin polymerized from G-actin, with phalloidin causing the transformation of the entire G-actin into F-actin that is no longer available for the formation of the filamentous web. The filamentous web may participate in the release of water due to its contractile action.

3475 REGIONAL VARIATIONS IN ELECTROLYTE CONTENT OF SMOOTH MUSCLE OF OPOSSUM ESOPHAGUS: EFFECTS OF INHIBITION OF Na^+-K^+ ATPase [Abstract]. (Eng.) Schulze, K.; Hajjar, J. J.; Christensen, J.; Miller, S. (Univ. Iowa Coll. Medicine, Iowa City, IA 52242). *Fed. Proc.* 36(3):462; 1977.

3476 VENOUS ANGIOARCHITECTURE OF THE TUNICA MUSCULARIS IN THE ESOPHAGOGASTRIC TRANSITION SEGMENT IN MAN. (Eng.) Fujimura, I.; Ferraz de Carvalho, C. A. (Dept. Anatomy, Univ. San Paulo, Av. Dr. Arnaldo, 455, Sao Paulo, Brazil). *Acta Anat. (Basel)* 98(4):401-412; 1977.

3477 COMPARATIVE ULTRASTRUCTURE OF THE SURFACE EPITHELIUM OF STOMACH AND ESOPHAGUS [Abstract]. (Eng.) Friedman, M. H. F.; Marchant, L. M. (Philadelphia Coll. Osteopathic Medicine, Philadelphia, PA). *Gastroenterology* 72(5, Part 2):1059; 1977.

3478 THE SALIVARY GLANDS: ANATOMY AND EMBRYOLOGY. (Eng.) Johns, M. E. (Walter Reed Army Medical Center, Washington, DC 20012). *Otolaryngol. Clin. North Am.* 10(2):261-271; 1977.

3479 GROSS AND MICROSCOPIC ANATOMY OF THE MAJOR SALIVARY GLANDS OF THE FERRET. (Eng.) Poddar, S.; Jacob, S. (Dept. Anatomy, Univ. West Indies, Mona, Kingston 7, Jamaica). *Acta Anat. (Basel)* 98(4):434-443; 1977.

3480 SALIVARY GLAND PHYSIOLOGY. (Eng.) Rice, D. H. (Wadsworth Hosp. Center, Wilshire and Sawtelle Boulevards, Los Angeles, CA 90073). *Otolaryngol. Clin. North Am.* 10(2):273-285; 1977.

3481 RECENT ADVANCES IN THE INVESTIGATION OF ENDOCRINE CELLS OF THE GUT [Abstract]. (Eng.) Polak, J. M.; Bishop, A. E.; Pearse, A. G. (Royal Postgraduate Medical Sch., London, England). *Rend. Gastroenterol.* 9(1):57-58; 1977.

3482 MULTIPLE HORMONAL APUD CELLS [Abstract]. (Eng.) Bishop, A. E.; Polak, J. M.; Bloom, S. R.; Buchan, A. M. J.; Pearse, A. G. E. (Royal Postgraduate Medical Sch., London W12 OHS, England). *Acta Endocrinol. (Kbh.)* 85(Suppl. 212): 103; 1977.

See also, 3510, 3519, 3521, 3544, 3557, 3577, 3587, 3598, 3600, 3608, 3643, 3769, 3770, 3775, 3779, 3780, 3783, 3784, 3801, 3806, 3813, 3822, 3824, 3851, 3862, 3873, 3895, 3938, 3976.

3483 TRANSPORT OF FAT THROUGH JEJUNAL ABSORPTIVE EPITHELIUM IN VITRO. (Eng.) Mohiuddin, A.; Ahmed, M. M.; Chan, H. L. (Univ. Riyadh, Riyadh, Saudia Arabia). *Acta Anat.* 100(4):435-440; 1978.

The transport of fat through jejunal absorptive epithelium *in vitro* was studied in the white rat to determine the functional role of the infranuclear cytoplasm of the epithelial cells. The mucosa of excised pieces of jejunum from fasting rats was exposed for 10 min to fresh chyme obtained from other rats that had been digesting either buttered bread or bread alone and was then processed for electron microscopy. After exposure to fatty chyme, very fine lipid globules were seen between microvilli; larger globules were found in the supranuclear cytoplasm of all epithelial cells and in the infranuclear cytoplasm of some. The globules were found tightly bunched in supranuclear Golgi apparatus, and smaller collections were found in the infranuclear Golgi apparatus of some cells. Globules of an intermediate size were scattered more evenly in the cytoplasm both above and below the level of the nucleus. Occasional lymphatics in the villus core contained fat globules. Vesicles of little density were contained throughout the cells. But the most notable feature was the large collection of finely granular deposit in the deepest part of the infranuclear region between the mitochondria and endoplasmic reticulum above and the plasmalemma resting on the basement membrane below. These collections caused considerable elongation of the cells toward the lamina propria, and appeared to be nonlipid material conveyed there for clearance through the cell but not yet expelled due to the absence of blood flow through the villus. After exposure to chyme that did not contain fat, no globules of fat were seen in the epithelial cells or the lamina propria, but the low-density vesicles were more numerous in the cytoplasm, and the basal parts of the cells contained an even larger collection of finely granular nonlipid material than in the experiment with fatty chyme. The results support the hypothesis that infranuclear cytoplasm of absorptive epithelial cells takes part in the transport of absorbed fat, whose globules are collected in the infranuclear and supranuclear Golgi apparatus, but the possibility still exists that absorbed fat may leave through the sides of cells without reaching the bases.

3484 IDENTIFICATION OF KETONE BODIES AND GLUTAMINE AS THE MAJOR RESPIRATORY FUELS IN VIVO FOR POSTABSORPTIVE RAT SMALL INTESTINE. (Eng.) Windmueller, H. G.; Spaeth, A. E. (Natl. Inst. Health, Bethesda, MD 20014). *J. Biol. Chem.* 253 (1):69-76; 1978.

The *in vivo* metabolism of circulating substrates was studied quantitatively in rat jejunal segments with an intact arterial supply and totally collected venous drainage. Net uptake or release of various blood metabolites was measured chemically, and the steady state rates of metabolism of arterial substrates to venous products were measured radiochemically. The major carbon sources taken up were glutamine, acetoacetate, 3-hydroxybutyrate, and glucose. Net uptake of each was in the range of 160 to 220 nmol/min/g intestine, which was equivalent to 30% of the circulating flux through the tissue for glutamine, 10% to 15% for the ketone bodies, and 2% for glucose. Plasma unesterified fatty acids were poorly utilized, less than 1% of the flux being taken up. Glutamine carbon was the source for about 35% of the CO_2 produced and ketone bodies for an additional 50%. The remaining CO_2 was derived from glucose (7%), lactate (5%), and unesterified fatty acids (3%). Additional end products for glutamine and ketone body carbon included lactate and, to a smaller extent, glucose. Glucose carbon atoms taken up were largely recovered as lactate and alanine, suggesting weak pyruvate dehydrogenase activity. Although the jejunum produced lactate, it also metabolized about 10% of the circulating lactate flux through the tissue, mostly to alanine. Half of the carbon of alanine released by jejunum was derived from blood lactate and the rest from the other metabolized substrates. Lactate uptake exceeded release when blood concentrations exceeded 1.2 to 1.6 mM. Nitrogenous end products of glutamine metabolism included NH_3 and alanine, and smaller amounts of ornithine, citrulline, and proline. These results identify ketone bodies and glutamine as the major respiratory fuels in postabsorptive small intestine *in vivo* and provide additional details regarding intermediary metabolism in this tissue.

3485 EFFECT OF TRANSIENT INTESTINAL ISCHAEMIA ON THE THORACIC DUCT LYMPH ABSORPTION OF ENDOTOXIN. (Eng.) Nozickova, M.; Bartos, V.; Sedlak, J. (Inst. Clinical and Experimental Medicine, Budejovicka 800, 146 22 Praha 4, Czechoslovakia). *Lymphology* 10(3):161-165; 1977.

Changes of the thoracic duct lymph flow and composition attending intestinal ischemia and following intestinal revascularization were studied in eight mongrel dogs to assess the role of lymph vessels for the transport of toxic substances produced by or resorbed from the ischemic intestine. One-hour intestinal ischemia was produced by clamping the superior mesenteric artery and interrupting the intramural collaterals; revascularization was followed for 4 hr. Intestinal ischemia was associated with a decrease ($p<0.01$) in thoracic duct lymph flow, an increase in lymph/plasma ratio for total protein ($p<0.05$), and a rapid increase in the lactic acid level only in the blood of mesenteric vein ($p<0.01$). Lactic acid level remained elevated ($p<0.01$) in mesenteric venous blood and became elevated in the lymph ($p<0.01$) and arterial blood ($p<0.05$) during revascularization. LDH activity increased in mesenteric venous blood during ischemia and remained elevated during revascularization ($p<0.01$); in the lymph and in arterial blood, LDH levels rose ($p<0.01$ and $p<0.05$, resp.) during revascularization. The lymph/plasma ratio for total protein decreased significantly ($p<0.05$) after 1 hr of revascularization, and the thoracic duct lymph hematocrit was significantly ($p<0.01$)

elevated between 0.5 and 2 hr of revascularization. Using the limulus test, endotoxin activity was found in the lymph of four of six dogs and in the mesenteric vein blood in one dog before intestinal ischemia but was absent in arterial blood. After the 1 hr of ischemia, endotoxin was present in the lymph of all six dogs and in the venous blood of one. After 1 hr of revascularization, endotoxin was present in the thoracic duct lymph of six dogs, intestinal venous blood of four dogs and arterial blood of three dogs. It is concluded that during intestinal ischemia lymph transport from the gut is low but may be sufficient for the transport of endotoxin. Transport via the intestinal lymph significantly increases after revascularization, and limulus-positive substances escape from the ischemic intestine both via the lymph and blood.

3486 QUANTITATIVE RELATIONS BETWEEN THE MONOSACCHARIDE-INDUCED CHANGE OF ION TRANSPORT AND MONOSACCHARIDE ACCUMULATION IN THE RAT JEJUNUM. (Ger.) Remke, H.; Muhle, W.; Mothes, T.; Muller, F. (Physiologisch-Chemisches Institut, Karl-Marx-Universitat, 701 Leipzig, E. Germany). *Acta Biol. Med. Ger.* 36(7):7-15; 1977.

The changes induced by the Na^+-dependent transport of monosaccharides (10 mM) in the unidirectional influx of Na^+ and K^+ ions through the microvillous membrane (brush border) were studied in *in vitro* preparations of the rat jejunum. The monosaccharide-induced change in the Na^+ and K^+ influx was found to be a function of the ion gradients at the brush border. The monosaccharide-induced change in the permeability of the brush border also caused a decrease in the K^+ concentration and an increase in the Na^+ concentration during the energy-dependent accumulation of the monosaccharide. The monosaccharide concentration in the tissue reached an end value that was proportional to the change in the Na^+ and K^+ influx and to the change in the ion concentration; this end value remained unchanged even when the Na^+ gradient was eliminated and the intracellular K^+ concentration was low. The correlation between the elimination of the ion gradients and the rise in the monosaccharide concentration is explained by the monosaccharide-induced restriction of the active ion transport and the resulting change in the energy dissipation in favor of monosaccharide transport. The $(Na^+ + K^+)$-ATPase in the brush border is discussed as the possible transmitter of energy from the ion gradients.

3487 CORRELATION OF cGMP BUT NOT cAMP WITH SODIUM TRANSPORT IN INTESTINE [Abstract]. (Eng.) Gerzer, R.; Kautz, U.; Loeschke, K. (Medizinische Klinik der Universitat, Innenstadt, Ziemssenstrasse 1, D-8000 Munchen 2, W. Germany). *Pfluegers Arch.* 368(Suppl.):R21; 1977.

3488 REGIONAL CAPACITIES OF GASTROINTESTINAL ABSORPTION AND LYMPHATIC TRANSPORT FOR LIPID-SOLUBLE DYES IN RATS. (Eng.) Noguchi, T.; Tokunaga, Y.; Ichikawa, H.; Muranishi, S.; Sezaki, H. (Faculty Pharmaceutical Sciences, Kyoto Univ., Yoshida Shimodachi-cho, Sakyo-ku, Kyoto, Japan). *Chem. Pharm. Bull.* 25(3):413-419; 1977.

3489 THE SIGNIFICANCE OF VEHICLE OIL METABOLISM IN THE ABSORPTION PROCESS OF LIPID-SOLUBLE COMPOUNDS. (Eng.) Noguchi, T.; Taniguchi, K.; Muranishi, S.; Sezaki, H. (Faculty Pharmaceutical Sciences, Kyoto Univ., Yoshida Shimoadachi-cho, Sakyo-ku, Kyoto, Japan). *Chem. Pharm. Bull.* 25(3): 434-440; 1977.

3490 THE EFFECT OF HEAT INACTIVATION OF SOYBEAN TRYPSIN INHIBITOR ON PROTEIN AND LIPID ABSORPTION IN MAN [Abstract]. (Eng.) Linscheer, W. G.; Raheja, K. L. (Veterans Admin. Hosp., Syracuse, NY). *Gastroenterology* 72(5, Part 2):1175; 1977.

3491 CHARACTERIZATION OF THE INDIVIDUAL COMPONENTS OF INTESTINAL FOLATE TRANSPORT [Abstract]. (Eng.) Dhar, G. J.; Selhub, J.; Gay, C.; Rosenberg, I. (Pritzker Sch. Medicine, Univ. Chicago, Chicago, IL). *Gastroenterology* 72(5, Part 2):1049; 1977.

3492 PARTIAL PURIFICATION FROM LIVER PLASMA MEMBRANCE (LPM) OF A PROTEIN COMPONENT POSSIBLY INVOLVED IN ORGANIC ANION TRANSPORT [Abstract]. (Eng.) Tiribelli, C.; Lunazzi, G. C.; Frezza, M.; Sottocasa, G. L. (Istituti di Patologia Medica e Chimica Biologica, Univ. Trieste, Trieste, Italy). *Digestion* 14(5/6):470; 1976.

3493 A NEW METHOD FOR ASSESSING Zn ABSORPTION IN MAN [Abstract]. (Eng.) Aamodt, R. L.; Rumble, W. F.; Johnston, G. S.; Henkin, R. I. (Natl. Inst. Health, Bethesda, MD). *Clin. Res.* 25(3):306A; 1977.

3494 ANTIEPILEPTIC DRUG ABSORPTION FROM RAT JEJUNUM IN VIVO [Abstract]. (Eng.) Tramposch. A.; Abbatiello, E. R.; Pippenger, C. E. (St. John's Univ., Jamaica, NY 11439). *Fed. Proc.* 36(3): 1021; 1977.

3495 EXPERIMENTAL STUDIES ON THE INTESTINAL ABSORPTION OF DIPHENYLHYDANTOINE (DPH) [Abstract]. (Eng.) Johansson, O.; Lindberg, T. (No affiliation given). *Acta Paediatr. Belg.* 29(2): 132; 1976.

3496 DETECTION OF RADIOACTIVE FATTY ACIDS DURING THEIR INTESTINAL ABSORPTION BY THE RAT. (Eng.) Carlier, H. (Laboratoire de Physiologie de la Nutrition U.E.R., Univ. de Dijon, 21000 Dijon, France). *J. Microsc. Biol. Cell.* 27(2/3): 239-242; 1976.

3497 A SPECIFIC ACTION OF ASPIRIN ON GASTRIC CELL MEMBRANE [Abstract]. (Eng.) Koelz, H. R.; Fischer, J.; Sachs, G.; Blum, A. L. (Univ. Hosp. Orthopedics, CH-Zurich, Switzerland). *Gastroenterology* 72(5, Part 2):1082; 1977.

See also, 3588, 3700, 3771, 3782, 3784, 3800, 3811, 3901.

MOTILITY

3498 DYNAMIC RESPONSE CRITERIA FOR FLUID-FILLED ESOPHAGEAL MANOMETERS. (Eng.) Klingler, D. R.; Harell, G. S.; Zboralske, F. F. (Utah Biomedical Test Lab., 520 Wakara Way, Salt Lake City, UT 84108). *Invest. Radiol.* 12(6):515-519; 1977.

To ascertain the predominant frequencies in the peristaltic waveform, a system of two infused fluid-filled manometers was constructed in which each manometer responded in a significantly different manner to sinusoidal pressure fluctuations above 1 Hz in *in vitro* testing. Peristaltic pressure recordings *in vivo* in the distal third of the normal human esophageal body revealed no significant difference in the tracings obtained from the two manometers, indicating that only pressure fluctuations below 1 Hz were significant in determining the shape of normal distal esophageal peristaltic waveforms. Similar methodology may be applied for determining the predominant frequencies in other parts of the normal esophagus and for determining the predominant frequencies in esophageal motility disorders.

3499 ESOPHAGEAL MOTILITY IN THE ELDERLY. (Eng.) Khan, T. A.; Shragge, B. W.; Crispin, J. S.; Lind, J. F. (Univ. Manitoba Health Science Center, 700 William Ave., Winnipeg, Canada R3E 0Z3). *Am. J. Dig. Dis.* 22(12):1049-1054; 1977.

The effect of age on esophageal motility was studied manometrically by comparing 49 asymptomatic subjects over 60 yr of age with 43 similar subjects under 40 yr of age. The resting pressures and the responses to deglutition were recorded in the esophagus, lower esophageal sphincter (LES), and the stomach. Although the pressures in the LES were similar in the two groups, the LES response to deglutition was inadequate in 17.8% of swallows in those over 60 yr of age and in only 5.9% in those under 40 yr ($p<0.003$). Inadequate LES response was characterized by either a complete absence of response or absence of contractile phase. The amplitude of sphincteric response to deglutition was less in older persons, due mainly to a decrease in the amplitude of contraction. In the body of the esophagus the peristaltic contractions were weaker and progressed more slowly in the older group. The incidence of disordered contractions was significantly higher in the older group (25.3% versus 8.2%, $p<0.001$). Spontaneous gastroesophageal reflux was seen in 9 of the 49 subjects over 60 yr of age and in none under 40 yr of age. The changes in swallowing patterns indicate a degree of neuromuscular degeneration. They simulate those seen in neuromuscular esophageal disorders such as diffuse spasm and gastroesophageal reflux. Recognition of the age-related changes is important in interpreting esophageal motility patterns in the elderly.

3500 EFFECT OF ACID ON THE MOTILITY OF THE OESOPHAGUS OF THE PIG WITH EXPERIMENTALLY INDUCED OESOPHAGITIS. (Eng.) Punto, L.; Koivisto, E. (Dept. Diagnostic Radiology, Univ. Oulu, Oulu, Finland). *Scand. J. Gastroenterol.* 12(7):776-780; 1977.

Studies were performed to determine whether an acid contrast medium disturbs motor activity in the pig esophagus that has been damaged with hydrochloric acid. Eight pigs were used, two of them as control. Six animals were fed twice a day with 400 ml of HCl solution (pH 1.2) for 6 weeks. In five animals, a condition resembling esophagitis developed. Prior to the study and at intervals of 2 weeks, simultaneous radiologic and manometric examinations of the esophagus were performed, using the conventional barium sulfate or acid barium sulfate suspension as contrast media in 10-ml bolus doses. In two pigs, esophagoscopy was made three weeks after the test began. With conventional medium, all pigs showed normal peristalsis and pressure recordings of a normal swallowing complex with respect to amplitude, duration, and speed of peristaltic wave. Acid barium sulfate caused spasms and nonperistaltic pressure waves during swallowing of the contrast medium by four of the five pigs with experimental esophagitis, whereas, at the beginning of the experiment, normal peristalsis and swallowing complex had been present in all animals. In one animal, the changes were observed by 2 weeks after the beginning of experiment, while in the others they

occurred after 6 weeks. The fact that control pigs did not show any pathological motor disturbances with acid contrast medium indicates that mucosal damage causes the motor disturbances provoked by the medium.

3501 PROSTAGLANDIN E_2 EFFECT ON LOWER ESOPHAGEAL SPHINCTER PRESSURE AND SERUM GASTRIN. (Eng.) Maher, J. W.; Hollenbeck, J. I.; Crandall, V.; McGuigan, J.; Woodward, E. R. (Coll. Medicine, Univ. Florida, Gainesville, FL 32610). *J. Surg. Res.* 24(2):87-91; 1978.

The effects of 15-methyl analogs of prostaglandin E_2 (15 Me PGE_2) on lower esophageal sphincter pressure (LESP) and serum gastrin levels were studied in six mongrel dogs prepared with slit esophagostomies. After a 2-week recovery period, the dogs underwent three fasting esophageal motility studies, and blood was sampled for serum gastrin determinations. Esophageal motility studies and blood sampling were then repeated at 20, 30, and 40 min following i.v. injection of 15 Me PGE_2 (0.5 µg/kg). Serum gastrin was determined by radioimmunoassay, and LESP was measured as mean end expiratory pressure. Two additional dogs had motility studies repeated with 15 Me PGE_2 in doses 0.05, 0.2, 0.5, and 1.0 µg/kg to construct a complete dose-response curve in which the response was expressed as the change in LESP from basal values. All animals showed an increase in LESP after administration of PGE_2 when compared to the control value (from 29.2 ± 1.3 versus 19.2 ± 1.2 cm H_2O, $p<0.001$), the increase being large and significant ($p<0.005$) in four dogs and small and not significant in two dogs. The two dogs for whom dose-response curves were constructed also showed a large increase in LESP following injection of 15 Me PGE_2 (0.5 µg/kg). There were no differences in the response strength at the different time intervals measured. The LESP increased significantly following the administration of doses of 0.2, 0.5, and 1.0 µg/kg 15 Me PGE_2 while there was no significant increase at 0.05. Serum gastrin levels after administration of 15 Me PGE_2 (0.05 µg/kg) were unchanged from control studies (24.4 ± 5.0 pg/ml versus 16.2 ± 2.4 pg/ml). The studies strongly suggest that inhibition of gastrin release is not the mechanism of action of 15 Me PGE_2 on LESP. The usefulness of the drug as adjuvant therapy in peptic ulcer disease and reflux esophagitis awaits further study.

3502 EFFECT OF Salmonella typhimurium ON MYOELECTRICAL ACTIVITY IN THE RABBIT ILEUM. (Eng.) Weisberg, P. B.; Carlson, G. M.; Cohen, S. (Sch. Medicine, Univ. Pennsylvania, Philadelphia, PA). *Gastroenterology* 74(1):47-51; 1978.

The small intestinal myoelectrical response to *Salmonella typhimurium* was studied using the ligated ileal loop model in male New Zealand white rabbits. Three strains of *S. typhimurium* were used: strain TML, which causes mucosal damage and increased fluid output; strain M-206, which causes increased fluid output but minimal mucosal damage; and strain LT-7, which causes mucosal damage but no increase in fluid output. Strains TML and M-206 produced groups of abnormal action potential bursts (APBs). An APB was defined as action potential activity by a duration of 1.5 sec or longer occurring in at least two adjacent electrode recording sites. The mean onset time of APB activity was 4.0 ± 0.5 hr after infection with TML and 5.25 ± 0.84 hr after infection with M-206 ($p>0.05$). After onset, the abnormal myoelectrical pattern persisted for the duration of all recording periods (up to 24 hr). Three distinct configurations of APBs were observed: (1) aborad propagation, (2) orad propagation, and (3) less organized bidirectional propagation from the point of origin, termed "splits." All APBs were associated with intestinal contractions. Strain LT-7 did not produce any APBs. Control experiments consisted of recording from noninfected loops, loops injected with sterile saline or sterile culture broth, loops infused with saline at 11.2 ml/hr, and loops infused with 800 mOsm of mannitol at 11.64 ml/hr. APB activity was not observed in any of the control experiments. These data indicate that, in addition to the secretory abnormalities seen in *Salmonella* diarrhea, there is a small intestinal myoelectrical disturbance consisting of abnormal APBs. The myoelectrical disturbance is seen with organisms known to produce increased fluid output, and it apparently occurs independently of the mucosal damage caused by *Salmonella*.

3503 EFFECTS OF ETHANOL ON ELECTRICAL PARAMETERS OF THE IN VIVO RAT STOMACH. (Eng.) Biggerstaff, R. J.; Leitch, G. J. (Indiana Univ. Sch. Medicine, 8600 Univ. Blvd., Evansville, IN 47712). *Am. J. Dig. Dis.* 22(12):1064-1068; 1977.

The gastric transmural electrical potential difference (PD) and direct-current resistance were measured in the rat *in vivo* under conditions in which the luminal pH was controlled over the pH range 1.0 to 12.0. Raising the pH above 11.0 caused a reduction in both PD and resistance. This result is consistent with basic groups limiting cation permeability through the mucosa. Exposure of the mucosa to 20% ethanol caused a reduction in resistance, PD, and H^+ secretion, and an increased appearance of Na^+ in the lumen at neutral pH. The pH dependence of the resistance at high pH values was also eliminated, consistent with the elimination or bypassing of channels containing basic groups. Mucosal exposure to 8.5% ethanol reduced the PD and H^+ secretion without affecting resistance. Exposing the mucosa to a sucrose solution (1.2 M) that approximated the effective osmolarity of the 8.5% ethanol showed that the net Na^+ flux effect of this concentration of alcohol was probably due to its hyperosmolarity. Both the reduced PD and H^+ secretion seen with the alcohol solution, but not with the sucrose, indicated that the active transport inhibition by this concentration of alcohol was probably a direct effect of the ethanol.

3504 INHIBITORY EFFECT OF PENTAGASTRIN AND FEEDING ON NATURAL AND MOTILIN-INDUCED INTERDIGESTIVE CONTRACTIONS IN THE STOMACH OF CONSCIOUS DOGS. (Eng.) Itoh, Z.; Takeuchi, S.; Aizawa, I.; Couch, E. F. (Gunma Univ. Sch. Medicine, Maebashi, 371 Japan). *Gastroenterol. Jpn.* 12(4): 284-288; 1977.

The interaction between motilin, pentagastrin, and feeding was investigated during the interdigestive gastric motor state in four healthy conscious dogs. The i.v. infusion of synthetic motilin always induced a pattern identical with that of the naturally occurring interdigestive stomach contractions. Pentagastrin completely inhibited the interdigestive contractions at doses of 0.2-1.6 μg/kg/hr; this inhibition was dose-related to the occurrence of the motilin-induced contractions. Food ingestion strongly inhibited both the naturally occurring contractions and the motilin-induced contractions. These findings support the hypothesis that the interdigestive contractions in the dog are, at least in part, controlled by motilin.

3505 MANOMETRIC AND ELECTROMYOGRAPHIC STUDIES OF THE UPPER ESOPHAGEAL SPHINCTER [Abstract]. (Eng.) Asoh, R.; Goyal, R. K. (Univ. Texas Health Science Center, Dallas, TX). *Gastroenterology* 72(5, Part 2):1025; 1977.

3506 FORCE-LENGTH RELATIONSHIPS OF THE LOWER ESOPHAGEAL SPHINCTER (LES) [Abstract]. (Eng.) Biancani, P.; Kerstein, M. D.; Weiss, R. M.; Behar, J. (Yale Univ., New Haven, CT 06510). *Fed. Proc.* 36(3):462; 1977.

3507 TERTIARY CONTRACTIONS OF THE ESOPHAGUS: A MANOMETRIC STUDY IN HEALTHY SUBJECTS [Abstract]. (Eng.) Orlando, R. C.; Bozymski, E. M.; Blaylock, N. B. (Univ. North Carolina Sch. Medicine, Chapel Hill, NC). *Gastroenterology* 72 (5, Part 2):1109; 1977.

3508 THE MYOGENIC ACTIVE TENSION THAT DEFINES LOWER ESOPHAGEAL SPHINCTER IS AEROBIC [Abstract]. (Eng.) Templeman, D. C. (Dept. Medicine, Univ. Iowa, Iowa City, IA). *Gastroenterology* 72(5, Part 2):1189; 1977.

3509 THE SIGNIFICANCE OF LOWER ESOPHAGEAL SPHINCTER PRESSURE ASYMMETRY IN MAN AND ITS CORRELATION WITH A NEW MEASURE OF CLOSURE STRENGTH [Abstract]. (Eng.) Luckmann, K.; Welch, R. W. (Univ. Texas Health Science Center, San Antonio, TX). *Gastroenterology* 72(5, Part 2):1091; 1977.

3510 NEURAL CONTROL OF LOWER ESOPHAGEAL SPHINCTER (LES) CLOSURE [Abstract]. (Eng.) Behar, J.; Kerstein, M.; Biancani, P. (Dept. Medicine, Brown Univ., Providence, RI 02902). *Gastroenterology* 72(5, Part 2):1029; 1977.

3511 EFFECTS OF GRADED DOSES OF ALCOHOL UPON ESOPHAGEAL AND LOWER ESOPHAGEAL SPHINCTER (LES) FUNCTION [Abstract]. (Eng.) Mayer, E. M.; Grabowski, C. J.; Fisher, R. S. (Temple Univ. Medical Sch., Philadelphia, PA). *Gastroenterology* 72(5, Part 2):1099; 1977.

3512 EFFECT OF PHARMACOLOGIC AGENTS ON PRIMARY ESOPHAGEAL PERISTALSIS IN THE OPOSSUM [Abstract]. (Eng.) Dodds, W. J.; Christensen, J.; Wood, J.; Arndorfer, R. C. (Medical Coll. Wisconsin, Milwaukee, WI). *Gastroenterology* 72(5, Part 2): 1050; 1977.

3513 HISTAMINE PHARMACOLOGY OF THE LOWER ESOPHAGEAL SPHINCTER [Abstract]. (Eng.) Brown, F. C.; Dubois, A.; Castell, D. O. (Natl. Naval Medical Center, Bethesda, MD). *Clin. Res.* 25(3):466A; 1977.

3514 ROLE OF HISTAMINERGIC RECEPTORS IN THE CONTROL OF HUMAN LOWER ESOPHAGEAL SPHINCTER (LES) FUNCTION [Abstract]. (Eng.) Kravitz, J. J.; Snape, W. J., Jr.; Cohen, S. (Hosp. Univ. Pennsylvania, Philadelphia, PA). *Gastroenterology* 72(5, Part 2):1084; 1977.

3515 LOWER ESOPHAGEAL SPHINCTER PRESSURE (LESP) RESPONSE TO INTRAVENOUS INFUSIONS OF PENTAGASTRIN (PG) [Abstract]. (Eng.) Corazziari, E.; Pozzessere, C.; Dani, S.; Delle Fave, G. F.; De Magistris, L.; Anzini, F. (II Clinica Medica, Universita di Roma, Roma, Italy). *Gastroenterology* 72(5, Part 2):1041; 1977.

3516 THE EFFECT OF SMOKING ON ESOPHAGEAL PERISTALSIS [Abstract]. (Eng.) Chernow, B.; Brown, F. C.; Castell, D. O. (Natl. Naval Medical Center, Bethesda, MD 20014). *Gastroenterology* 72(5, Part 2):1038; 1977.

3517 SIMULTANEOUS RECORDING OF GASTRIC AND DUODENAL ELECTRICAL ACTIVITY (ELECTROGASTROGRAPHY) [Abstract]. (Eng.) Civalero, L. A.; Kantelius, M.; Nilsson, B. Y. (No affiliation given). *Electroencephalogr. Clin. Neurophysiol.* 43(3):444; 1977.

3518 SEMICONDUCTOR STRAIN GAUGE SENSING AND TELEMETERING OF GASTRIC MOTILITY IN GREAT-HORNED OWLS [Abstract]. (Eng.) Fuller, M. R.; Duke, G. E.; Kuechle, V. B. (Coll. Veterinary Medicine, Univ. Minnesota, St. Paul, MN 55108). *Fed. Proc.* 36(3):462; 1977.

3519 MECHANICAL CHARACTERISTICS OF THE PYLORUS [Abstract]. (Eng.) Biancani, P.; Zabinski, M. P.; Behar, J. (Yale Univ., New Haven, CT 06510). *Gastroenterology* 72(5, Part 2):1029; 1977.

3520 PHYSIOLOGIC EFFECTS OF CCK AND CCK OCTAPEPTIDE ON THE MECHANICAL AND INTRACELLULAR ELECTRICAL ACTIVITY OF CANINE ANTRAL CIRCULAR MUSCLE [Abstract]. (Eng.) Morgan, K. G.; Schmalz, P. F.; Go, V. L. W.; Szurszewski, J. H. (Mayo Medical Sch., Rochester, MN). *Gastroenterology* 72(5, Part 2): 1105; 1977.

3521 ISOLATED GASTRIC MUSCLE CELLS: DEMONSTRATION OF THE DIRECT MYOGENIC EFFECT OF CHOLECYSTOKININ [Abstract]. (Eng.) Bitar, K. N.; Zfass, A. M.; Farrar, J. T.; Makhlouf, G. M. (Medical Coll. Virginia, Richmond, VA). *Gastroenterology* 72(5, Part 2):1030; 1977.

3522 HISTAMINE$_2$ RECEPTOR INVOLVEMENT IN THE REGULATION OF GASTRIC EMPTYING [Abstract]. (Eng.) Dubois, A.; Hamilton, B.; Castell, D. O. (Uniformed Services, Univ. Health Sciences, Bethesda, MD). *Gastroenterology* 72(5, Part 2):1051; 1977.

3523 CYCLIC CHANGES IN PLASMA MOTILIN LEVELS AND INTERDIGESTIVE MYOELECTRIC ACTIVITY OF CANINE ANTRUM AND DUODENUM [Abstract]. (Eng.) Lee, K. Y.; Chey, W. Y.; Tai, H. H.; Wagner, D.; Yajima, H. (Genesee Hosp., Rochester, NY). *Gastroenterology* 72(5, Part 2):1162; 1977.

3524 DROP IN GASTRIC POTENTIAL DIFFERENCE AFTER PENTAGASTRIN UNRELATED TO OXYNTIC CELL STIMULATION [Abstract]? (Eng.) Tarnawski, A.; Krause, W.; Ivey, K. J. (Veterans Admin. Hosp., Columbia, MO). *Gastroenterology* 72(5, Part 2): 1139; 1977.

3525 TRANSMUCOSAL POTENTIAL DIFFERENCE IN RAT UPPER GASTROINTESTINAL TRACT. A SIMPLE MODEL SIMILAR TO HUMAN STUDIES [Abstract]. (Eng.) Tarnawski, A.; Ivey, K. J. (Veterans Admin. Hosp., Columbia, MO). *Gastroenterology* 72(5, Part 2): 1138; 1977.

3526 SMALL BOWEL MOTILITY PATTERNS IN HUMANS FOLLOWING ORALLY ADMINISTERED ANTI-DIARRHEAL DRUGS [Abstract]. (Eng.) Friedman, G.; Korsten, M. (Mt. Sinai Sch. Medicine, New York, NY). *Gastroenterology* 72(5, Part 2):1059; 1977.

3527 THE TWO MUSCLE LAYERS OF DUODENUM DIFFER IN RESPONSE TO PARASYMPATHOMIMETIC DRUGS, HISTAMINE, AND SUBSTANCE P [Abstract]. (Eng.) Faulk, D.; Anuras, S.; Christensen, J. (Univ. Iowa Hosp., Iowa City, IA). *Gastroenterology* 72(5, Part 2):1057; 1977.

3528 ENHANCEMENT BY PHYSALAEMIN OF THE CONTRACTIONS INDUCED BY CHOLINOMIMETICS IN THE GUINEA-PIG ILEUM [Letter to Editor]. (Eng.) Fontaine, J.; Famaey, J. P.; Reuse, J. (Inst. Pharmacy, Univ. Burssels, Campus Plaine CP 205/7, Boulevard du Triomphe, 1050, Brussels, Belgium). *J. Pharm. Pharmacol.* 29(7):449-450; 1977.

3529 OUABAIN-SENSITIVE CONTRACTILE RESPONSE TO 13-NORLEUCINE MOTILIN OF RABBIT DUODENAL MUSCLE [Abstract]. (Eng.) Ruppin, H.; Riemer, J.; Mayer, C. J.; Kolling, K.; Domschke, W.; Wunsch, E.; Demling, L. (Dept. Physiology, Univ. Munchen, Munich, W. Germany). *Gastroenterology* 72(5, Part 2): 1123; 1977.

3530 INTRACELLULAR RECORDINGS OF SLOW WAVES FROM INFLAMED SMOOTH MUSCLE OF THE COLON [Abstract]. (Eng.) Duff, W. M. (Univ. Utah Medical Center, Salt Lake City, UT). *Gastroenterology* 72 (5, Part 2):1052; 1977.

3531 EFFECT OF DIPYRIDAMOLE AND 6-(2-HYDROXY-5-NITRO)-BENZYLTHIOGUANOSINE ON LOW-FREQUENCY-STIMULATED RELAXATION IN THE GUINEA PIG TAENIA COLI. (Eng.) Baer, H. P.; Frew, R.; Burnstock, G. (Dept. Pharmacology, Univ. Alberta, Edmonton, Alberta, T6G 2H7, Canada). *Can. J. Physiol. Pharmacol.* 55(3):394-398; 1977.

3532 REGULATION OF COLONIC MOTILITY AND BLOOD FLOW. (Eng.) Hulten, L. (Sahlgrens Hosp., S-413 45 Goteborg, Sweden). *Nutr. Rev.* 35(3):38-41; 1977.

3533 ELECTRICAL ACTIVITY OF GANGLION CELLS IN THE CELIAC PLEXUS OF THE GUINEA PIG [Abstract]. (Eng.) Kreulen, D. L.; Szurszewski, J. H. (Mayo Medical Sch., Rochester, MN 55901). *Fed. Proc.* 36(3):462; 1977.

3534 GASTROINTESTINAL PROKINETIC AND ANTIEMETIC EFFECTS OF A NEW SUBSTITUTED PYRIMIDINE, O 6553 (2-METHYLAMINO-4-N-METHYLPIPERAZINO-5-THIOMETHYL-6-CHLOROPYRIMIDINE HYDROCHLORIDE). (Eng.) Loiseau, G.; Millischer, R.; Donadieu, A. M.; Marquet, J. P. (Recherche et Pharmacie, Groupe Pharmuka, 35, quai du Moulin de Cage, F-92231 Gennevilliers, France). *Drug Res.* 27(I, 3):606-611; 1977.

3535 EFFECTS OF THE SPHINCTER OF ODDI AND DUODENAL MOTILITY UPON FLOW THROUGH THE BILE DUCT [Abstract]. (Eng.) Scott, G. W.; Broughton, A. C. (Surgical Medical Res. Inst., Univ. Alberta, Edmonton, Alberta T6G 2N8, Canada). *Eur. Surg. Res.* 9(Suppl. 1):156; 1977.

See also, 3475, 3568, 3597, 3615, 3793, 3801, 3811, 3859, 3860, 3890, 3967, 3968, 4007, 4176.

3536 THE ROLE OF CALCIUM IN PAROTID AMYLASE SECRETION EVOKED BY EXCITATION OF CHOLINERGIC, α- AND β-ADRENERGIC RECEPTORS. (Eng.) Petersen, O. H.; Ueda, N.; Hall, R. A.; Gray, T. A. (Asahikawa Univ. Sch. Medicine, Asahikawa, Japan). *Pfluegers Arch.* 372(2):231-237; 1977.

Amylase output from superfused mouse parotid segments was monitored by an on-line automated fluorometric method. During exposure to Ca^{2+}-free solution containing 10^{-4} M EGTA (ethylene glycol-bis-[β-amino ethyl ether]), excitation of α-adrenoceptors or cholinergic receptors only resulted in a very small and transient increase (<10%) in amylase output. Admission of Ca^{2+} during sustained stimulation caused a marked, sustained rise in amylase output. During exposure to Ca^{2+}-free solution containing EGTA, excitation of β-adrenoceptors caused the usual marked rise in amylase output and the enhanced amylase secretion was sustained. Admission of Ca^{2+} during sustained isoproterenol stimulation only caused a small transient rise in amylase output. The effect of acetylcholine (ACh) on amylase output varied with the extracellular Ca^{2+} concentration, being reduced at subnormal extracellular levels and enhanced during superfusion with fluid containing 20 mM Ca^{2+}. Mn^{2+} (5 mM) acted as a stimulant of amylase secretion even in the presence of blocking agents for the cholinergic, α-, and β-adrenergic receptor sites. The effect of Mn^{2+} was biphasic; an initial transient increase in amylase output was followed by a slowly developing sustained increase in secretion. The initial response was abolished after pretreatment with EGTA in a Ca^{2+}-free solution. Adding 5 mM Mn^{2+} just after the addition of ACh had caused maximal amylase secretion resulted in an immediate reduction in amylase output. Adding Mn^{2+} and ACh simultaneously to the superfusion solution resulted in a response smaller than that expected for ACh alone. The effect of ACh during continued exposure to Mn^{2+} was greatly reduced compared to control conditions. Stimulation with Mn^{2+} during continued exposure to isoproterenol resulted in a marked transient increase in amylase output. The action of stimulants exciting cholinergic and α-adrenergic receptors is entirely dependent on extracellular Ca^{2+}, whereas the action of stimulants exciting adrenergic β-receptors is relatively independent of Ca^{2+}. Mn^{2+} immediately inhibits ACh-evoked amylase secretion probably by reducing Ca^{2+} influx. Mn^{2+} is, however, also a stimulant of amylase secretion, probably by displacement of membrane-bound cell Ca^{2+}.

3537 CHARACTERIZATION OF GLYCOSPHINGOLIPIDS OF RAT SUBLINGUAL AND SUBMAXILLARY GLANDS [Abstract]. (Eng.) Slomiany, B. L.; Slomiany, A. (New York Medical Coll., Valhalla, NY 10595). *Adv. Exp. Med. Biol.* 89:520-521; 1977.

3538 HORMONAL CONTENT OF COMMERCIAL PREPARATIONS OF CHOLECYSTOKININ-PANCREOZYMIN [Abstract]. (Eng.) Oliver, J. M.; Harvey, R. F. (Bristol Royal Infirmary, Bristol, England). *Gut* 18(11):A982; 1977.

3539 THE EFFECT OF IN UTERO PROTEIN MALNUTRITION AND SUBSEQUENT RENUTRITION ON RAT SALIVA AND SOME SALIVARY ENZYMES. (Eng.) Watson, R. R. (Indiana Univ. Sch. Medicine, 1100 W. Michigan St., Indianapolis, IN 46202). *Br. J. Nutr.* 38(2): 233-238; 1977.

3540 IN VITRO TECHNIQUES FOR STUDIES ON PITUITARY REGULATION OF RAT LIVER ENZYMES. (Eng.) Stenberg, A.; Eneroth, P.; Gustafsson, J. A.; Skett, P. (Karolinska Institutet, S-104 01 Stockholm, Sweden). *J. Steroid Biochem.* 8(5): 603-607; 1977.

3541 HORMONAL CONTROL OF THE SPHINCTER OF ODDI. (Eng.) Rey, J. F.; Harvey, R. F. *In: The Sphincter of Oddi.* Edited by J. Delmont. (Basel: S. Karger): 66-71; 1977.

3542 SOMATOSTATIN-LIKE IMMUNOREACTIVITY IN GASTRODUODENAL MUCOSA IN MAN [Abstract]. (Eng.) Chayvialle, J. A. P.; Bouhours, D.; Bernard, C.; Lambert, R. (INSERM, U 45, Pav. H bis, Hopital Edouard-Herriot, 69374 Lyon, France). *Digestion* 16(1/2):206-207; 1977.

3543 SECRETORY POTENTIALS EVOKED BY SYMPATHETIC STIMULATION OF THE PAROTID GLAND OF CAT [Abstract]. (Eng.) Thesleff, P.; Emmelin, N.; Grampp, W. (Dept. Physiology, Biophysics, Univ. Lund, Lund, Sweden). *Acta Physiol. Scand.* 102(1): 16A-17A; 1978.

3544 DEPENDENCE OF SALIVARY SECRETION, PASSIVE AND ACTIVE POTASSIUM TRANSPORT ON FLOW RATE IN THE PERFUSED SUBMANDIBULAR GLAND [Abstract]. (Eng.) Laugesen, L. P.; Nielsen, J. O. D.; Poulsen, J. H. (Inst. Medical Physiology, Univ. Copenhagen, Copenhagen, Denmark). *Acta Physiol. Scand.* 102(1): 19A-20A; 1978.

See also, 3480, 3481, 3778, 3813, 4062, 4086.

3545 STIMULI FOR INTESTINAL PHASE OF GASTRIC SECRETION IN DOGS. (Eng.) Konturek, S. J.; Radecki, T.; Kwiecien, N. (Medical Acad., Krakow, Poland). *Am. J. Physiol.* 234(1):E64-E69; 1978.

In four dogs with a special gastroduodenal fistula that allowed complete separation of the stomach and the duodenum, various food chemicals (albumin, liver extract, amino acid mixture, individual amino acids, carbohydrate, fat, and saline) were instilled into the duodenum, and their ability to stimulate gastric acid and serum gastrin secretion were compared. The liver extract meal was the most effective stimulant of both gastric acid and serum gastrin secretion, whereas albumin and the amino acid mixture (made up to simulate the amino acid composition of albumin or liver extract) were less potent stimulants. The i.v. administration of the amino acid mixture was also an effective stimulant of gastric acid secretion but not of serum gastrin. Individual amino acids, instilled intraduodenally in 50 mM solutions, varied in stimulatory activity; the most active were serine, proline, glycine, leucine, and valine, whereas tyrosine, cysteine, aspartic acid, histidine, and tryptophan did not cause a significant increase of gastric acid secretion over saline control. L-isomers of the most active amino acids produced significantly greater acid outputs than did their D-isomers. The carbohydrate and fat meals in the intestine were ineffective in stimulation of gastric secretion. The results indicate that protein and its digestive products, peptides and amino acids, are stimulants of the intestinal phase of gastric secretion and that this stimulation involves release of gastrin, the direct action of the absorptive products on the oxyntic glands, and perhaps other mechanisms.

3546 MEASUREMENT OF GASTRIC ACID SECRETION IN ISOLATED GASTRIC MUCOSA OF THE RAT: EFFECTS OF SECRETAGOGUES AND INHIBITORS INCLUDING CYCLIC ADENOSINE MONOPHOSPHATE RELATED AGENTS AND AN H_2-RECEPTOR ANTAGONIST. (Eng.) Watanabe, K.; Watanabe, H. Y.; Goto, Y.; Kariya, Y. (Dept. Pharmacometrics, Res. Inst. Wakan-yaku, Univ. Toyama, Japan). *Chem. Pharm. Bull. (Tokyo)* 25(8):1934-1940; 1977.

An improved, reproducible, and sensitive method, which is a modification of the open stomach preparation of rats, for the measurement of gastric acid secretion in isolated rat gastric mucosa was used to measure the effects of certain secretagogues and antisecretory drugs in this system. This technique differs from the open stomach procedure by using immature rats that are not fasted before the experiment, by eliminating the stomach muscle layer, and by setting the pH-stat at 4.0. Dose-dependent acid secretory responses were obtained to all the tested secretagogues in the following dose ranges: 10^{-6}-10^{-4} g/ml histamine, 3×10^{-8}-3×10^{-6} g/ml bethanecol, 3×10^{-6}-6×10^{-5} g/ml tetragastrin, and 10^{-5}-10^{-3} g/ml dibutyryl cyclic AMP (DBcAMP); however, the maximum response to tetragastrin was always less as compared with that of other secretagogues. The effects of atropine (10^{-6} g/ml), metiamide (10^{-4} g/ml), Dibucaine (10^{-4} g/ml), sodium thiocyanate (10^{-3} g/ml), and 2,4-dinitrophenol (2,4-DNP, 10^{-4} g/ml) on acid secretion stimulated by bethanecol (10^{-6} g/ml), tetragastrin (10^{-5} g/ml), histamine (1×10^{-5} g/ml), and dibutyryl cyclic AMP DBcAMP (10^{-4} g/ml), were studied. Atropine achieved a significant inhibition ($p<0.01$) only against the action of bethanecol. Dibucaine and sodium thiocyanate strongly inhibited ($p<0.01$) the action of all the secretagogues. Metiamide significantly inhibited ($p<0.01$) the action of histamine and tetragastrin but only partially depressed ($p<0.05$) the action of bethanecol and was ineffective against DBcAMP. 2,4-DNP abolished the sensitivity of the gastric mucosa to all secretagogues ($p<0.01$) and even blocked basal secretion. Cyclic AMP (10^{-3} g/ml), cyclic guanosine monophosphate (cGMP, 10^{-4} g/ml), and DBcGMP (10^{-4} g/ml) failed to stimulate acid secretion, whereas theophylline (10^{-3} g/ml) gave a marked stimulation of acid output (change=1,200 ± 202 mμEq H^+/10 min) in tests to examine cyclic nucleotides other than DBcAMP. Imidazole (10^{-3} g/ml) significantly inhibited the action of bethanecol, histamine, and DBcAMP ($p<0.05$) and the action of tetragastrin ($p<0.01$). DBcGMP was ineffective as an antagonist of acid secretion and the results with prostaglandin E_1 (4×10^{-6} and 2×10^{-5}) were largely inconclusive except for inhibitory action against histamine ($p<0.05$).

3547 METABOLISM OF DOG GASTRIC MUCOSA: LEVELS OF GLYCOLYTIC, CITRIC ACID CYCLE AND OTHER INTERMEDIATES. (Eng.) Sarau, H. M.; Foley, J. J.; Moonsammy, G.; Sachs, G. (Smith, Kline and French Lab., Philadelphia, PA 19101). *J. Biol. Chem.* 252(23):8572-8581; 1977.

Metabolites of glycolysis, the citric acid cycle, the hexose monophosphate shunt, glutamate, aspartate, and coenzyme A (CoA) were measured in defined parietal cell-enriched freeze-dried sections of dog gastric biopsies derived from nonsecreting and secreting tissue. In addition, NH_3, ribulose-5-phosphate, glycerol, and succinate were measured in perchloric acid extracts of biopsies. The onset of secretion increased the level of glycolytic intermediates including pyruvate and lactate with the most marked increase being in fructose-1,6-diphosphate levels (181%). The level of 6-phosphogluconate and ribulose-5-phosphate also increased (by 117% and 64%, resp.), in spite of a constant $NADP^+$/NADPH ratio. The levels of all the citric acid cycle intermediates measured also rose, the most marked increases being in malate and fumarate (by 136% and 183%, resp.). The levels of glycerol, acetyl-CoA, and CoA increased, but the ratio of the latter intermediates remained constant. Calculation of the ratio of the oxidized to reduced form of diphosphopyridine nucleotide indicated a fall of the ratio in the cytoplasm and

a rise in the mitochondria. It is concluded that the major energy source for acid secretion is due to an increase in citric acid cycle activity and that glycolysis, and probably also fatty acid oxidation, is stimulated to provide mitochondrial substrate.

3548 EFFECT OF pH OF GASTRIC AND INTESTINAL MEALS ON GASTRIC ACID AND PLASMA GASTRIN AND SECRETIN RESPONSES IN THE DOG. (Eng.) Konturek, S. J.; Rayford, P. L.; Thompson, J. C. (Univ. Texas Medical Branch, Galveston, TX 77550). *Am. J. Physiol.* 233(6):E537-E543; 1977.

Studies were carried out in conscious dogs to determine the relationship between gastric acid secretion and changes in serum concentrations of gastrin and secretin in response to a meal at varying pH levels, when the meal was either confined to the stomach or perfused into the duodenum. In five dogs provided with a special cannula that allowed complete separation of the stomach and the duodenum, a 10% liver extract (LE) meal adjusted to pH levels ranging from 7 to 2 was introduced either into the stomach (gastric phase) or duodenum (intestinal phase). The LE meal (pH 7) in the stomach evoked an acid response equal to 75% of the maximal response to histamine; gastrin rose to about 230 pg/ml above the basal level. Acidification of the LE meal in the stomach resulted in a pH-dependent reduction in acid output and in gastrin levels; at pH 2, acid output was reduced by 85% and gastrin by 50%. Secretin was not changed by LE in the stomach at any pH. The LE meal (pH 7) in the duodenum stimulated gastric acid output to 30% of the histamine maximum and serum gastrin to about 40 pg/ml above the basal level. Acidification of the LE meal in the duodenum caused a pH-dependent fall in acid output, and, at pH 2, both acid output and gastrin level fell to the basal level. Conversely, secretin showed a pH-dependent increase, reaching 150 pg/ml above basal value at pH 2. Infusions of graded doses of secretin (0.25-2.0 U/kg/hr) during gastric or intestinal stimulation mimicked gastric acid and serum hormonal changes seen during duodenal acidification. In the intact stomach with undisturbed neural connections to the duodenum, a gastric LE meal was about three times as potent in stimulating gastric acid and serum gastrin release as an intestinal LE meal. Acidification of the LE meal produced inhibition of gastric acid output accompanied by a pH-dependent suppression of gastrin release in the gastric phase and a pH-dependent elevation of secretin release in the intestinal phase, but the decrease in gastrin and the increase in secretin do not fully account for the decreased acid secretion.

3549 EFFECT OF INDOMETHACIN AND ASPIRIN ON GASTRIC BLOOD FLOW AND ACID SECRETION. (Eng.) Gerkens, J. F.; Shand, D. G.; Flexner, C.; Nies, A. S.; Oates, J. A.; Data, J. L. (Clinical Pharmacology, Vanderbilt Univ., Nashville, TN 37232). *J. Pharmacol. Exp. Ther.* 203(3):646-652; 1977.

The effect of indomethacin and aspirin on basal and pentagastrin-stimulated gastric blood flow and acid secretion was studied in two groups of pentobarbital-anesthetized dogs. In group I, blood flow was measured with an electromagnetic flow probe around the left gastric artery. Indomethacin (8 mg/kg, i.v.) and aspirin (100 mg/kg, i.v.) reduced basal blood flow by 45% and 26%, resp., but did not change the small basal acid output. Both drugs increased blood pressure. Infusions of pentagastrin (0.025-0.5 µg/kg/min) stimulated acid output and increased blood flow. Indomethacin, injected during the pentagastrin infusion, further increased acid output by a peak of 266%, and reduced blood flow by 43%. Aspirin increased acid output by 104% and reduced blood flow by 39%. In group II, blood flow to different parts of the stomach and small intestine was measured using radioactive microspheres. Pentagastrin infusion increased blood flow in the antrum (30%), fundus (76%), and cardia (45%), and indomethacin (1 hr after starting pentagastrin) reduced total gastric blood flow by 45% to below control levels, all regions being affected. The gastric mucosal and muscular layers were separated and 90% of total flow was to the mucosa. The increase in blood flow produced by pentagastrin and the decrease produced by indomethacin both occurred in the mucosa while muscular blood flow was not altered. Pentagastrin also increased blood flow in the duodenum, jejunum, and ileum, and indomethacin counteracted these increases but did not reduce flow below control. In group III, gastric arterial blood flow was increased by intra-arterial infusions of sodium arachidonate. Indomethacin and aspirin reduced these increases by 72% and 60%, resp. It is concluded that the reduction in mucosal blood flow and potentiation of stimulated acid output by indomethacin and aspirin may be a consequence of prostaglandin synthesis inhibition and that these actions may contribute to the ulcerogenic effect of these drugs.

3550 PROTECTIVE EFFECT OF CIMETIDINE ON ASPIRIN-INDUCED GASTRIC MUCOSAL DAMAGE. (Eng.) MacKercher, P. A.; Ivey, K. J.; Baskin, W. N.; Krause, W. J. (Harry S Truman Memorial Veterans Hosp., Columbia, MO 65201). *Ann. Intern. Med.* 87(6):676-679; 1977.

The effect of cimetidine on aspirin-induced alterations in gastric mucosa was studied in five normal men. Aspirin effects were studied with and without previous treatment with cimetidine. The mean basal potential difference was -48 ± 1 mV. After 600 mg of aspirin p.o. in 1 dl of isotonic saline, the potential difference decreased in 10 min to -39 ± 1 mV ($p<0.001$) and returned to baseline within 60 min. Control biopsies showed 2% damaged mucosal cells compared with 20% damaged at the time of the maximal drop in potential difference ($p<0.001$) after aspirin. Recovery to 9% damage occurred by 60 min. In subjects pretreated p.o. with 300 mg cimetidine, the potential difference rose during 1 hr to -62 ± 1 mV ($p<0.001$). After aspirin potential difference fell to -48 ± 1 mV compared with -39 ± 1 mV with aspirin alone ($p<0.01$) and returned to -62 ± 1 mV at 60 min. The cimetidine-treated group showed 4% mucosal damage at the peak potential difference

fall after aspirin, significantly less ($p<0.02$) than in the untreated subjects. The results indicate that cimetidine protects against aspirin-induced mucosal damage, mainly via decreased acid secretion.

3551 THE EFFECT OF INTESTINAL FAT ON HISTAMINE-STIMULATED GASTRIC SECRETION. (Eng.) Wazna, M. F.; Stein, T.; Wise, L. (Long Island Jewish-Hillside Medical Center, New Hyde Park, New York, NY 11040). *J. Surg. Res.* 23(6):415-421; 1977.

The effect of intraduodenal fat infusion at a physiologic concentration (40 ml; 2 ml/min during first 10 min, 1 ml/min for the remaining 20 min) on histamine-stimulated gastric acid secretion was studied in female dogs with Heidenhain pouches. The dogs received histamine phosphate i.v. at a rate of 0.04 mg/kg/hr. There was a significant inhibition of acid output after fat administration (from 1.3 ± 0.1 to 0.5 ± 0.07 mEq/15 min, $p<0.001$), but there was no significant change in acid concentration. This result suggests that intraduodenal fat infusion inhibits gastric water secretion to the same extent as it inhibits gastric acid secretion. Histamine caused a marked initial increase in pepsin output ("washout" effect), followed by a secondary sustained increase. The intraduodenal administration of fat abolished the secondary increase in pepsin secretion. The depressant effect of intraduodenal fat on gastric acid and pepsin secretion may play a significant role in the prevention of peptic ulceration.

3552 CHARACTERIZATION OF ANTRAL GASTRIN CELLS WITH REGION-SPECIFIC ANTISERA. (Eng.) Larsson, L. I.; Rehfeld, J. F. (Inst. Medical Biochemistry, Univ. Aarhus, Aarhus, Denmark). *J. Histochem. Cytochem.* 25(12):1317-1321; 1977.

Region-specific gastrin and cholecystokinin antisera are described. These antisera were used to characterize antral gastrin cells of mammalian (pig, dog, cat, rat) and submammalian (chicken, frog) species. A number of gastrin antisera, which in radioimmunoassay systems showed no or negligible cross-reactivity towards the structurally and functionally related peptide cholecystokinin, were found to react with both gastrin and cholecystokinin cells when used for immunocytochemistry. This discrepancy was shown to be due either to reactivity against a COOH-terminal region common to gastrin and cholecystokinin or to the occurrence of heterogenous antibody populations in the antisera. By differential absorptions, the latter type of antisera was rendered specific for gastrin. Antisera reactive against the NH_2-terminal, middle, or COOH-terminal regions of human heptadecapeptide gastrin were prepared and, together with a specific cholecystokinin antiserum, used for the characterization of antral gastrin cells of the different species. The results indicate that only the COOH-terminal region of gastrin is conserved during evolution.

3553 THE EFFECT OF GIH AND BOOTS SECRETIN AND CHOLECYSTOKININ ON DUODENAL ULCERS IN THE RAT. (Eng.) Joffe, S. N.; Ferrie, M. M. (Royal Infirmary, Glasgow, G4 OSF, Scotland). *Acta Hepato-gastroenterol. (Stuttg.)* 24(6):458-461; 1977.

The efficacy of preparations of secretin, cholecystokinin, and pancreozymin made by the Gastrointestinal Hormone Laboratory (GIH) or by Boots Pharmaceuticals in experimental duodenal ulcers was studied in 140 male Wistar rats. The rats were divided into six treatment groups: (I) 18 ml of saline (150 mmol) infused s.c. over 24 hr, (II) pentagastrin (4 µg/kg/min) and carbachol (0.8 µg/kg/min) in 18 ml of saline infused over 24 hr, (III) GIH secretin (0.125-1.00 clinical U/kg/hr) in 18 ml saline alone (a) or with pentagastrin and carbachol (b), (IV) Boots secretin (1-10 Crick-Harper-Raper [CHR] U/kg/hr) as in (a) or (b) above, (V) GIH cholecystokinin-pancreozymin (CCK-PZ, 1 Ivy-Dog U/kg/hr) as in (a) or (b) above, and (VI) Boots pancreozymin (1 CHR U/kg/hr) as in (a) or (b) above. After the experiment the animals were killed and the severity of lesions was graded on a scale from 0 to 6. Neither stomach nor duodenum mucosal changes were observed in groups I, III(a), IV(a), V(a), and VI(a). All rats from group II developed duodenal ulcers that had penetrated or perforated the serosa (grade 6). When GIH secretin was infused in a dose of 0.125 U/kg/hr with gastric secretagogues, the incidence of the ulcers was similar to that in rats given pentagastrin and carbachol alone. With increasing doses of GIH secretin, the incidence and severity of the secretagogue-induced lesions decreased, so that at 1 U/kg/hr, only 1/12 rats developed an ulcer. Boots secretin in doses 1-10 CHR U/kg/hr infused with the secretagogues had no protective effect. The Boots secretin was shown to be contaminated with CCK. Both GIH CCK-PZ and Boots pancreozymin, in combination with the secretagogues, produced a 100% incidence of duodenal ulcers, which were of greater severity and number than in the rats given the gastric secretagogues alone. In both clinical and laboratory studies, the hormone preparation used should be carefully considered to avoid the effect of contaminants.

3554 STUDIES ON GASTRIC MUCOSAL IgA: SEPARATION OF IMMUNOGLOBULIN RICH FRACTION FROM GASTRIC MUCOPROTEINS. (Eng.) Spohn, M.; McColl, I. (Guy's Hosp. Medical Sch., London SE1 9RT, England). *Biochem. Biophys. Res. Commun.* 79(3):837-842; 1977.

Human gastric mucosal scrapings were subjected to fractionation on an isopycnic CsCl gradient to investigate the distribution of IgA of human gastric mucus and to compare it with the distribution of mucoproteins. IgA was found between the 5th and 10th ml from the top of the tube (total volume, 12 ml). After twofold fractionation, the combined IgA-containing fraction accounted for 4-7% of the total carbohydrate content of the original gastric mucosal scrapings. Gas-liquid chromatography of sugars showed the fraction to be en-

riched in mannose and *N*-acetyl glucosamine. The total carbohydrate content of the material was 5.5-7% by weight. Immunodiffusion against specific antisecretory component serum failed to demonstrate the presence of the secretory component in this fraction. It is concluded that gastric mucosal IgA, which appears to differ from a typical serum IgA in lacking the characteristic secretory component activity, can be separated from the carbohydrate-rich gastric mucoproteins by CsCl fractionation. This finding indicates the absence of covalent bonding between IgA and the mucoproteins of gastric mucus.

3555 PROSTAGLANDIN CYTOPROTECTION OF GASTRIC MUCOSA. (Eng.) Chaudhury, T. K.; Jacobson, E. D. (Univ. Texas Medical Sch., Houston, TX). *Gastroenterology* 74(1):58-63; 1978.

The possibility that prostaglandins protect the gastric mucosa by stimulation of the active transport of sodium was tested in dogs. Paired mucosal segments from the corpus of the stomach were mounted between bathing chambers to allow measurement of unidirectional fluxes of ^{22}Na, the electrical potential difference (PD) across the mucosa that is generated by the active transport of sodium, and the short-circuit current. The electrical resistance (R) was calculated from Ohm's law. The flux of ^{22}Na from serosa to mucosa ($J^{Na}_{s\rightarrow m}$)is an index of the passive transport of the ion and is a measure of membrane permeability. The difference between the two unidirectional fluxes (J^{Na}_{net}) represents the rate of active transport of the ion. If a topical damaging drug acted exclusively by increasing membrane permeability, one would anticipate the following responses to the agent: increased $J^{Na}_{s\rightarrow m}$, little effect on J^{Na}_{net}, decreased PD, and decreased R. Adding indomethacin (2.2×10^{-4} M) to the mucosal bathing solution caused no change in $J^{Na}_{s\rightarrow m}$, decreases in both J^{Na}_{net} and PD, and an increase in R. These findings suggest a primary effect on active transport of sodium. Effects of indomethacin on J^{Na}_{net}, PD, and R were reversed by 16,16 dimethyl prostaglandin E_2 (8×10^{-7} M) and by agents known to increase intracellular cyclic AMP content (theophylline and dibutyryl cyclic AMP). Incubation of mucosae with the prostaglandin increased measured cyclic AMP content 60% at a time before the full electrophysiological response. These data support the hypothesis that active transport of sodium is inhibited by a damaging agent and is stimulated by a protective agent, the latter appearing to act via increased accumulation of intracellular cyclic AMP.

3556 EFFECT OF 16,16-DIMETHYL PROSTAGLANDIN E_2 METHYL ESTER ON GASTRIC SECRETION INDUCED BY PENTAGASTRIN AND PEPTON [sic] MEAL IN MAN. (Eng.) Swierczek, J.; Kwiecien, N.; Oleksy, J.; Konturek, S. J. (Instytut Fizjologii, Grzegorzecka 16, 31-531 Krakow, Poland). *Acta Physiol. Pol.* 27(2):131-138; 1976.

The effect of 16,16-dimethyl prostaglandin E_2 methyl ester (PG/D, 1.25 µg/kg) on gastric secretion in 14 healthy male volunteers was studied to evaluate its usefulness in inhibiting gastric secretion and ulcer formation. Gastric secretion was stimulated by pentagastrin (i.v., 2 µg/kg/hr) or by a pepton meal (10% aqueous solution, continuous intragastric flow). The intragastric administration of PG/D resulted in 60% inhibition of gastric secretion in the first hour of the pentagastrin test; this inhibition diminished to 42% by the third hour; pepsin output was inhibited about 40% in the first hour. PG/D caused almost complete inhibition of gastric acid response to a pepton meal together with a marked decline of gastric pepsin concentration and serum gastrin concentration. PG/D caused a decline of total mucoprotein (TMP) output from 254 ± 52.59 to 164.4 ± 43.59 mg/hr from the first to the third hours, compared to a basal output of 82.4 ± 18.14 mg/hr and a control output of 80.9 ± 20.57 mg/hr, ($p<0.01$); the effect was due mainly to the fall in volume output since no significant changes in TMP concentration were found. No side-effects or changes in blood pressure, heart rate, body temperature, or results of laboratory tests were found during the secretory studies with PG/D or in succeeding 24 hr after PG/D administration. The possible usefulness of PG/D in the treatment of peptic ulcer disease is suggested.

3557 RENEWAL OF MOUSE GASTRIC MUCOUS CELLS FOLLOWING FAST NEUTRON IRRADIATION: AN ULTRASTRUCTURAL AND CARBOHYDRATE HISTOCHEMICAL STUDY. (Eng.) Wattel, W.; Geuze, J. J.; de Rooij, D. G.; Davids, J. A. G. (Medical Faculty, State Univ., Nicolaas Beetsstraat 22, Utrecht, Netherlands). *Cell Tissue Res.* 183(3):303-318; 1977.

Mouse gastric mucosa was studied ultrastructurally and histochemically after exposure to fast neutron irradiation, and the results were compared with those in the normal stomach. The number of cells per gastric gland was decreased after irradiation (1.0 MeV, 400 rads), and the glands were shorter. At day 9 following irradiation, several glands showed a dilated lumen lined by flattened cells. Between days 9 and 16, some of the glands disappeared. Parietal and chief cells disappeared from the remaining glands. At the same time, restoration of the mucosa started. At day 6, proliferative cells were scattered along the isthmus. As in controls, the isthmus contained a few undifferentiated cells, many differentiating surface mucous cells (SMC) with developing rough endoplasmic reticulum and silver proteinate-reactive Golgi element, and small secretory granules. At day 9, numerous proliferative cells were clustered in foci. Almost all these cells contained silver proteinate-reactive Golgi elements, granules, and vesicles. Most of them were SMC, others mucous neck cells (MNC) or intermediates. At day 16, proliferative foci were larger and consisted of differentiated mucous cells. Regenerated foveolae and glands consisted of large SMC and MNC and a few fibrillovesicular cells. In conclusion, proliferative activity is confined to undifferentiated cells and differentiating mucous cells, which identifies them as the progenitors of the other gastric cell types.

3558 STRESS ULCER--AN EXPERIMENTAL STUDY. (Ger.) Kokoschka, R.; Gober, I.; Gebhart, W. (I. Chirurgische Universitatsklinik, Alser Strasse 4, A-1090 Vienna, Austria). *Wien. Klin. Wochenschr.* 89(16):553-562; 1977.

The effect of hypovolemic shock, induced by the withdrawal of blood from the femoral artery for 1-4 hr, on the perfusion of the stomach and the development of stress ulcer was studied in 14 mongrel dogs. Compared with an initial value of 66.73 ml/kg of body weight, the aortic blood flow was reduced to 46.79 ml/kg after 1-hr bleeding and to 36.37 ml/kg after 4 hr. The blood flow in the celiac artery was reduced from 6.56 ml/kg to 3.96 ml/kg after 4 hr, and the blood flow in the gastric artery, measured after bleeding for 4 hr, was 0.64 ml/kg versus an initial value of 1.62 ml/kg. The central venous pressure showed no significant change during the experiment, while the serum gastrin level dropped from 43.85 µg/ml to 33.66 µg/kg after 4 hr. Significant histological changes were seen in the gastric mucosa as a result of the hemodynamic changes, especially when the duration of the shock was 4 hr. All stages of stress ulcer from superficial erosion to deep ulcers were documented. Loss of the superficial epithelium and its replacement by necrobiotic zones and depletion and degranulation of mast cells were seen. The findings suggest that mast cells may play a mediator role in the pathogenesis of stress ulcer.

3559 CHANGES IN GASTRIC GLANDULAR CELL KINETICS AFTER SMALL BOWEL RESECTION IN THE RAT. (Eng.) Seelig, L. L., Jr.; Winborn, W. B.; Weser, E. (Univ. Texas Health Science Center at Dallas, 5323 Harry Hines Blvd., Dallas, TX 75235). *Gastroenterology* 74(1):1-6, 1978.

The various types of gastric gland epithelial cells involved in the hyperplastic response to intestinal resection were studied in male Sprague-Dawley rats after a 50% resection involving the proximal small intestine. Two months after the operation, resected and control animals were given either a single or four successive i.p. injections of [^{3}H]thymidine (1 µCi/g). Animals from each group were killed 1 hr after the single injection and 3, 7, 30, and 60 days after the first multiple dose injection of [^{3}H]thymidine. At all periods after the multiple [^{3}H]thymidine doses, the percentages of labeled parietal and chief cells were significantly increased in animals with small bowel resection when compared with corresponding controls ($p<0.05$, $p<0.01$, $p<0.05$, and $p<0.001$ for parietal cells at each day, resp.; $p<0.01$, $p<0.05$, $p<0.001$, and $p<0.01$ for chief cells, resp.). The percentages of labeled mucous cells of the gastric glands were also increased in animals with small bowel resection at the 3- and 7-day periods. One hour after the single injection of [^{3}H]thymidine, the percentage of labeled gastric mucosal progenitor cells in animals with small bowel resection, although increased, was not significantly different from that in controls. It is, therefore, believed that the increases in percentage labeling of gastric glandular epithelial cells at 3, 7, 30, and 60 days could not solely be explained on the basis of an increased turnover rate of gastric progenitor cells. Rather, it might be concluded that the increase in glandular epithelial cells is accomplished, in part, by increased differentiation of gastric progenitor cells.

3560 FOLLOW-UP STUDY OF GASTRIN RESPONSE AFTER RESECTION OF THE JEJUNUM AND THE ILEUM. (Eng.) Kajiwara, T.; Tamura, K.; Suzuki, T. (Kyoto Univ. Medical Sch., Shogoin, Sakyo-ku, Kyoto, 606, Japan). *Ann. Surg.* 186(6):694-699; 1977.

The effect of jejunal or ileal resection on gastrin release was studied in dogs. The i.v. infusion of L-arginine (0.5 g/kg for 30 min) was the most practical in evaluating gastrin release in addition to insulin and glucagon release. Serum gastrin levels in response to this dose of arginine were determined before, and 3 weeks, 3 months, and 1 yr after the resection of the jejunum or ileum. At 3 weeks, a significant increase in gastrin levels occurred in both the fasting state and after stimulation in dogs with either jejunum or ileum resection. At 3 months, the elevated gastrin response persisted only in those with jejunal resection. By 1 yr, the gastrin levels had fallen in almost all dogs to approximately the preoperative levels. These and other studies suggest that serum gastrin does not always play a main role in the hyperacidity in the later stage after massive intestinal resection.

3561 INCREASED MEAL-STIMULATED GASTRIC ACID SECRETION AND SERUM GASTRIN AFTER EXTENSIVE SMALL BOWEL RESECTION IN PUPPIES. (Eng.) Wolf, S. A.; Telander, R. L.; Dozois, R. R.; Go, V. L. W. (Mayo Clinic, Rochester, MN 55901). *J. Pediatr. Surg.* 12(6):921-927; 1977.

The effects of massive resection of the small intestine (80% of the jejunum and ileum) on gastric acid secretion and serum gastrin level induced by feeding (ground boiled beef liver) were studied in six beagle puppies provided with vagally denervated pouches of the oxyntic gland area. Littermates were randomly assigned either as controls (nonresected) or as experimental (resected) animals. The mean basal acid output did not significantly differ within littermate pairs or between the entire control and resected groups (22 ± 8 and 20 ± 6 µEq/hr, resp.). However, the acid response during the 5th, 6th, 7th, and 8th hr after meal ingestion was significantly greater ($p<0.05$) in the resected group than in the control group. The cumulative acid output was 10.1 ± 1.8 mEq/8 hr in the resected group compared with 4.0 ± 1.4 mEq/8 hr in the control group ($p<0.05$). The mean fasting serum gastrin concentrations in control dogs (94 ± 10 pg/ml) did not significantly differ from those in resected dogs (64 ± 12 pg/ml). However, in littermate pairs, the mean serum gastrin concentrations at 6, 7, and 8 hr were significantly ($p<0.05$) greater in resected than in control puppies. Total integrated gastrin levels were significantly ($p<0.05$) less in littermate control puppies (22.3 ± 2.9 and 56.4 ± 15.7

ng/ml/8 hr) than in littermate resected puppies (61.3 ± 20.0 and 139.9 ± 19.6 ng/ml/8 hr). The integrated serum gastrin values during the 5th and 6th hr and during the 7th and 8th hr were significantly ($p<0.05$) greater after resection than before. The increase in gastric acid output correlated linearly with the acid and hypergastrinemia.

3562 EXPERIMENTAL GASTRIC SYMPATHECTOMY: AN EFFECTIVE PROPHYLAXIS OF GASTRIC STRESS LESIONS. (Eng.) Hottenrott, C.; Seufert, R. M.; Kuhne, F. W.; Busing, M. (Dept. Surgery, Univ. Heidelberg, Heidelberg, W. Germany). *Ann. Surg.* 186 (6):762-765; 1977.

The possible value of sympathectomy in the prevention of gastric stress ulceration was tested. Fifteen mini-pigs were bled to a mean aortic blood pressure of 40 mm Hg and maintained at that level for 3 hr. The control group consisted of eight animals with shock for 3 hr; the test group was comprised of seven animals with a similar shock period but they had undergone splanchnicectomy 14 days earlier. In all animals, a stimulated gastric secretion test was performed 3 days before and 8 days after splanchnicectomy. All controls showed severe gastric mucosal lesions after shock. Conversely, the piglets with splanchnicectomy developed no changes (5 animals) or only minor changes (2 animals). The efficacy of splanchnicectomy was confirmed by a stimulated gastric secretion test in which basal acid output did not change after operation (0.56 ± 0.35 mEq/l/30 min before and 0.20 ± 0.06 mEq/l/30 min after), but peak acid output increased significantly (from 2.99 ± 0.52 mEq/l/30 min to 5.35 ± 0.41 mEq/l/30 min, $p<0.0025$). This study suggests that gastric splanchnicectomy prevents gastric ulceration following experimental shock in pigs.

3563 ROLE OF THE SYMPATHETIC NERVOUS SYSTEM IN PEPTIC ULCER PRODUCTION IN RATS. (Eng.) Moraes, M. F.; Nyhus, L. M.; Kalahanis, N. G.; Bombeck, C. T.; Das Gupta, T. K. (Abraham Lincoln Sch. Medicine, P.O. Box 6998, Chicago, IL 60680). *Surgery* 83(2):194-199; 1978.

The role of the sympathetic nervous system in gastric acid secretion and in experimental cysteamine-induced (400 mg/kg, s.c.) duodenal ulceration was studied in male Sprague-Dawley rats. The animals were divided randomly into seven groups: (a) control, (b) sham-operated, (c) surgical sympathectomy, (d) chemical sympathectomy, (e) vagotomy, (f) surgical sympathectomy plus vagotomy, and (g) chemical sympathectomy plus vagotomy. Results on gastric acid secretion were expressed as gastric acid output (GAO=uEq of acid secretion in 1 hr). The means in the control and sham groups were 447.83 ± 26.67 GAO and 399 ± 36.4 GAO, resp. The means in the sympathectomized rats (surgically=562 ± 27.21 GAO and chemically=648.66 ± 46.53 GAO) were higher ($p<0.01$) than those of the control and sham groups. In the vagotomized group the mean was 156.6 ± 17.64 GAO, lower than those of the control and sham groups ($p<0.001$). The incidence of ulceration was 47.5% and 46% in the control and sham groups, resp. Both the sympathectomized groups (surgically, 73%; chemically, 77%), had a significantly elevated incidence of ulceration as compared with the controls ($p<0.01$). The vagotomized group had a 14% incidence of ulceration. These results indicate that sympathectomy affects both gastric acid secretion and the incidence of experimental peptic ulceration in rats.

3564 SURGICAL VAGOTOMY AND STOMACH WALL ATP AND ADP IN PYLORUS-LIGATED RATS. (Eng.) Mozsik, G.; Vizi, F. (Univ. Medical Sch., H-7643 Pecs, Hungary). *Am. J. Dig. Dis.* 22(12):1072-1075; 1977.

The stomach wall ATP and ADP levels were studied 24 hr after pylorus ligation in Wistar rats with and without bilateral surgical vagotomy. The amounts and concentrations of ATP and ADP significantly decreased in the corpus plus antrum and in the forestomach in pylorus-ligated rats ($p<0.001$), while the amounts and concentrations remained at a significantly higher level ($p<0.001$) in pylorus-ligated plus vagotomized rats. It is concluded that the breakdown of ATP is necessary to produce gastric hypersecretion and ulceration in pylorus-ligated rats. This decrease of cellular ATP can be prevented by bilateral surgical vagotomy.

3565 BODY WEIGHT AND GASTRIC ACID SECRETION IN RATS WITH SUBDIAPHRAGMATIC VAGOTOMY AND LATERAL HYPOTHALAMIC LESIONS. (Eng.) Opsahl, C. A.; Powley, T. L. (Yale Univ. Sch. Medicine, New Haven, CT 06508). *J. Comp. Physiol. Psychol.* 91(6): 1284-1296; 1977.

To investigate the role of the vagus in the lateral hypothalamic (LH) syndrome of body weight loss, male albino rats were divided into four groups: (a) animals with bilateral LH lesions that were subsequently given a bilateral subdiaphragmatic vagotomy, (b) LH animals that received a control vagotomy operation, (c) animals without lesions that underwent a subdiaphragmatic vagotomy, and (d) animals without lesions that underwent a control vagotomy operation. Both LH lesions and vagotomy reduced body weight levels, although the effects differed in terms of the length of time required to reach initial maximal loss, the time required to reach chronic levels of maintenance, and the severity of body weight reduction. Fasting gastric acid secretion was lowered by LH lesions ($p<0.05$), and the extent of this reduction was positively correlated with the reduction in body weight ($r=0.69$, $p<0.005$). Gastric contents after a 24-hr fast were greater in vagotomized rats than in nonvagotomized animals. The fact that the weight lowering effect of vagotomy was found to be much weaker in animals in which the lateral hypothalamus was intact than in the LH rats suggests that an intact lateral hypothalamus actively mitigates the effects of vagotomy. Alternatively, the exaggerated weight

loss observed as a result of the combined LH-lesion-vagotomy procedure might be evidence that intact vagal innervation is actually involved in minimizing the effects on body weight of LH lesions.

3566 COMPARISON OF AMINO ACIDS BATHING THE PYLORIC GLAND AREA IN THE STIMULATION OF GASTRIC ACID SECRETION [Abstract]. (Eng.) Konturek, S. J.; Tasler, J.; Cieszkowski, M.; Wunsch, E. (Inst. Physiology, Medical Acad., Krakow, Poland). *Gastroenterology* 72(5, Part 2):1083; 1977.

3567 SOME PROPERTIES SHARED BY AMINO ACIDS AND ENTERO-OXYNTIN [Abstract]. (Eng.) Landor, J. H.; Beloni, A.; Mariano, E. C. (CMDNJ-Rutgers Medical Sch., Piscataway, NJ). *Gastroenterology* 72(5, Part 2):1085; 1977.

3568 THE EFFECT OF INDIVIDUAL AMINO ACIDS (AA) ON GASTRIC EMPTYING TIME (GET) IN MAN [Abstract]. (Eng.) Byrne, W. J.; Walsh, J. H.; Ament, M. E. (Dept. Pediatrics, Univ. California, Los Angeles, CA 90024). *Gastroenterology* 72(5, Part 2):1035; 1977.

3569 EFFECT OF ACUTE ACETYLSALICYLIC ACID AND INDOMETHACIN ADMINISTRATION ON GASTRIC CELL LOSS IN MAN [Abstract]. (Eng.) Corinaldesi, R.; Casadio, R.; Fabbri, R.; Luchetta, L.; Ricci, P.; Barbara, L. (Cattedra di Gastroenterologia, Policlinico S. Orsola, Bologna, Italy). *Rend. Gastroenterol.* 9(1):80-81; 1977.

3570 PARENTERAL ASPIRIN AND THE GASTRIC MUCOSAL BARRIER [Abstract]. (Eng.) Guth, P. H.; Paulsen, G. (Wadsworth Veterans Admin. Hosp., Los Angeles, CA). *Gastroenterology* 72(5, Part 2):1066; 1977.

3571 ASPIRIN- AND BILE-INDUCED ACUTE EROSIVE GASTRITIS. ITS PREVENTION BY METIAMIDE THERAPY. (Eng.) Mann, N. S.; Sachdev, A. J. (Veterans Admin. Hosp., Louisville, KY). *Arch. Pathol. Lab. Med.* 101(4):206-207; 1977.

3572 PROTECTION AGAINST ASPIRIN-INDUCED GASTRIC MUCOSAL INJURY BY 16,16 DIMETHYL PROSTAGLANDIN E_2 [Abstract]. (Eng.) Miller, T. A.; Tepperman, E. L. (Univ. Texas Medical Sch., Houston, TX). *Gastroenterology* 72(5, Part 2):1102; 1977.

3573 EFFECT OF SOME ANTI-INFLAMMATORY DRUGS ON THE GASTRIC MUCOSAL BARRIER IN THE RAT [Abstract]. (Eng.) Baldi, F.; Salvati, P.; Righi, M.; Biasco, G.; Salera, M.; Miglioli, M.; Barbara, L. (Cattedra di Gastroenterologia dell' Universita, Bologna, Italy). *Rend. Gastroenterol.* 9(1):79; 1977.

3574 ATROPINE INCREASES THE GASTRIN RESPONSE AND SUPPRESSES THE GASTRIC INHIBITORY (GIP) RESPONSE TO A MEAL IN DOGS [Abstract]. (Eng.) Baumert, J.; Mazzaferri, E.; Tetirick, C.; Pace, W.; Cataland, S. (Dept. Medicine, Ohio State Univ., Columbus, OH). *Gastroenterology* 72(5, Part 2): 1028; 1977.

3575 COMPARATIVE EFFECTS OF L-DOPA, PROPEXYPHRENE, ACETOAMINOPHEN, INDOMETHACIN AND PHENYLBUTAZONE ON GASTRIC MUCOSA [Abstract]. (Eng.) Mann, N. S. (Veterans Admin. Hosp., Louisville, KY). *Gastroenterology* 72(5, Part 2):1095; 1977.

3576 GASTRIC EFFECTS OF PROPEXYPHENE, ACETOAMINOPHEN, INDOMETHACIN, PHENYLBUTAZONE AND TOLECTIN [Abstract]. (Eng.) Mann, N. S. (Veterans Admin. Hosp., Louisville, KY). *Gastroenterology* 72(5, Part 2):1095; 1977.

3577 BILE EXPOSURE INCREASES RESISTANCE OF GASTRIC MUCOSAL BARRIER TO RUPTURE [Abstract]. (Eng.) Scheurer, U.; Schlegel, J.; Kelly, D.; Code, C. F. (Veterans Admin. Wadsworth Hosp. Center, Los Angeles, CA). *Gastroenterology* 72(5, Part 2):1127; 1977.

3578 IN VIVO EFFECTS OF BILE SALTS ON ACID SECRETION BY THE RAT STOMACH [Abstract]. (Eng.) Elmasri, S. H.; Lewin, M. R.; Clark, C. G. (Univ. Coll. Hosp., Medical Sch., London, England). *Gut* 18(5):A405-A406; 1977.

3579 EFFECT OF BILE SAMPLES OF DIFFERENT BILE SALT COMPOSITION OF THE GASTRIC MUCOSAL BARRIER IN THE RAT [Abstract]. (Eng.) Baldi, F.; Salvati, P.; Salera, M.; Biasco, G.; Miglioli, M.; Barbara, L. (Cattedra di Gastroenterologia dell' Universita, Bologna, Italy). *Rend. Gastroenterol.* 9(1):51; 1977.

3580 CALCIUM STIMULATION OF GASTRIN AND GASTRIC ACID SECRETION: EFFECT OF SMALL DOSES OF CALCIUM CARBONATE [Abstract]. (Eng.) Behar, J.; Smyth, R. D. (Dept. Medicine, Brown Univ., Providence, RI). *Rend. Gastroenterol.* 9(11):59-60; 1977.

3581 CAPASAICIN INDUCED ACUTE EROSIVE GASTRITIS: ITS PREVENTION BY MYLANTA II, METIAMIDE AND CIMETIDINE [Abstract]. (Eng.) Mann, N. S. (Veterans Admin. Hosp., Louisville, KY). *Gastroenterology* 72(5, Part 2):1096; 1977.

3582 INTERACTION BETWEEN ACUTE GASTRIC ULCER AND EPINEPHRINE-INDUCED EROSIONS IN THE RAT. (Eng.) Raugstad, T. S.; Svanes, K.; Molster, A. (Dept. General Surgery, Haukeland Sykehus, N-5000 Bergen, Norway). *Eur. Surg. Res.* 9(1):67-73; 1977.

3583 THE CONTROL OF GASTRIC ACID SECRETION USING HISTAMINE H_2-RECEPTOR ANTAGONISTS [Abstract]. (Eng.) Barbezat, G. O.; Bank, S. (Groote Schuur Hosp., Cape Town, South Africa). *Rend. Gastroenterol.* 9(1):71; 1977.

3584 GASTRIN INDEPENDENT INDUCTION OF GASTRIC SECRETORY CAPACITY BY PROLONGED HISTAMINE-H2 BLOCKER TREATMENT [Abstract]. (Eng.) Hacki, W. H.; Hacki, S. K.; Witzel, L.; Halter, F. (Inselspital, Univ. Berne, Berne, Switzerland). *Acta Endocrinol. (Kbh.)* 85(Suppl. 212):195; 1977.

3585 VASODILATOR AND SECRETORY RESPONSES TO HISTAMINE H_1 AND H_2-RECEPTORS [Abstract]. (Eng.) Tepperman, B. L.; Tague, L. L.; Miller, T. A.; Pawlik, W.; Jacobson, E. D. (Univ. Texas Medical Sch., Houston, TX). *Gastroenterology* 72(5, Part 2):1140; 1977.

3586 EFFECT OF GROWTH HORMONE ON SERUM, ANTRAL AND DUODENAL GASTRIN IN HYPOPHYSECTOMIZED RATS [Abstract]. (Eng.) Teichmann, R. K.; Hill, F. C.; Rayford, P. L.; Thompson, J. C. (Univ. Texas Medical Branch, Galveston, TX). *Gastroenterology* 72(5, Part 2):1139; 1977.

3587 GASTRIC MUCOSAL GROWTH AFTER PROLONGED METIAMIDE TREATMENT: A SECRETORY AND MORPHOMETRIC STUDY IN THE RAT [Abstract]. (Eng.) Witzel, L.; Halter, F.; Olah, A.; Hacki, W. (Inselspital, Bern, Switzerland). *Rend. Gastroenterol.* 9(1):80; 1977.

3588 THE EFFECT OF METIAMIDE ON THE GASTRIC MUCOSAL BARRIER. (Eng.) Drew, R.; Freeman, T.; Fischer, R. P. (Saint Paul-Ramsey Hosp., 640 Jackson, Saint Paul, MN 55101). *J. Surg. Res.* 22(5):534-537; 1977.

3589 DIFFERENT EFFECTS OF VASOPRESSIN AND MECHANICAL ISCHEMIA ON OXYGENATION AND ELECTRICAL POTENTIAL IN THE GASTRIC MUCOSA [Abstract]. (Eng.) Bowen, J. C.; Salvato, P. D.; Garg, D. K.; Jacobson, E. D. (Ochsner Medical Inst., New Orleans, LA). *Gastroenterology* 72(5, Part 2):1031; 1977.

3590 EFFECT OF GASTRIC INTUBATION ON THE GASTRIC LOSS OF SERUM ALBUMIN [Abstract]. (Eng.) Brassinne, A. (Hopital de Baviere, Liege, Belgium). *Rend. Gastroenterol.* 9(1):75-76; 1977.

3591 CORRELATION BETWEEN GASTRIC PROTEIN KINASE AND SECRETION IN THE PYLORUS LIGATED RAT. (Eng.) Capobianco, J. O.; Mollison, K. W.; Lee, Y. H.; Lee, S. G.; Hung, P. P. (Dept. Pharmacology, Abbott Lab., North Chicago, IL 60064). *Biochem. Pharmacol.* 26(10):991-994; 1977.

3592 ACUTE EFFECTS OF TRUNCAL VAGOTOMY ON GASTRIC WALL TISSUE GASES IN THE DOG. (Eng.) Inberg, M. V.; Havia, T.; Niinikoski, J. (Dept. Surgery, Univ. Turku, Turku, Finland). *Acta Chir. Scand.* 143(1):57-62; 1977.

3593 PREVENTION OF STRESS ULCERATIONS WITH CIMETIDINE AND CARBENOXOLONE. (Eng.) Strauss, R. J.; Stein, T.; Mandell, C.; Wise, L. (Long Island Jewish-Hillside Medical Center, New Hyde Park, NY). *Surg. Forum* 28:361-363; 1977.

3594 CIMETIDINE PREVENTS STRESS-INDUCED GASTRIC EROSIONS. (Eng.) Levine, B. A.; Teegarden, D. K.; McLeod, C. G., Jr.; Sirinek, K. R.; Pruitt, B. A., Jr. (Brooke Army Medical Center, Fort Sam Houston, TX). *Surg. Forum* 28:359-361; 1977.

3595 PROTECTION OF GASTRIC MUCOSA AGAINST ASPIRIN-INDUCED EROSIONS BY ENHANCED BLOOD FLOW. (Eng.) McGreevy, J. M.; Moody, F. G. (Univ. Utah Coll. Medicine, Salt Lake City, UT). *Surg. Forum* 28:357-359; 1977.

3596 METHYLPREDNISOLONE PROTECTS AGAINST BILE-ACID-INDUCED ACUTE GASTRIC MUCOSAL ULCEROGENESIS. (Eng.) Cherry, K. J., Jr.; Ritchie, W. P., Jr. (Univ. Virginia Medical Center, Charlottesville, VA). *Surg. Forum* 28:355-357; 1977.

3597 EFFECT OF PARIETAL CELL VAGOTOMY AND SUBSEQUENT UNILATERAL TRUNCAL VAGOTOMY ON CANINE GASTRIC ACID SECRETION AND EMPTYING. (Eng.) Hardy, B. M.; Safaie-Shirazi, S.; Ehrhardt, J. C.; Chaudhuri, T. K. (Univ. Iowa Coll. Medicine, Iowa City, IA). *Surg. Forum* 28:353-355; 1977.

See also, 3473, 3497, 3501, 3503, 3522, 3542, 3766, 3773, 3774, 3826, 3834, 3869, 3881, 3936, 3948, 3964, 3967, 3978, 3986, 4266.

SECRETION AND METABOLISM

Pancreas

3598 DEVELOPMENT OF THE EMBRYONIC MAMMALIAN PANCREAS: THE RELATIONSHIP BETWEEN MORPHOGENESIS AND CYTODIFFERENTIATION. (Eng.) Spooner, B. S.; Cohen, H. I.; Faubion, J. (Div. Biology, Kansas State Univ., Manhattan, KS 66506). *Dev. Biol.* 61(2):119-130; 1977.

The degree to which cytodifferentiation is obligatorily coupled to ongoing morphogenesis was analyzed in the developing mouse pancreas system. Protodifferentiated pancreatic epithelia were isolated from investing mesoderm and cultured on plastic substrata. Within 24 hr, the epithelia spread into two-dimensional monolayers. Under these conditions, acinar formation failed to take place. The cells did not undergo mitosis, a finding consistent with the absence of mesenchymal cells or mesenchymal factor from these cultures. In spite of the absence of morphogenesis, cytodifferentiation took place on schedule. Thus, over 5-7 days of culture, amylase specific activity rose 100-fold, and zymogen granules appeared in the cells. The results indicate that the regulation of exocrine cytodifferentiation is independent of ongoing morphogenesis.

3599 INTRACELLULAR DIVALENT CATION RELEASE IN PANCREATIC ACINAR CELLS DURING STIMULUS-SECRETION COUPLING. I. USE OF CHLOROTETRACYCLINE AS FLUORESCENT PROBE. (Eng.) Chandler, D. E.; Williams, J. A. (Dept. Physiology, Univ. California, San Francisco, CA 94143). *J. Cell Biol.* 76(2): 371-385; 1978.

Stimulus-secretion coupling in pancreatic exocrine cells was studied using dissociated acini, prepared from mouse pancreas, and chlorotetracycline (CTC), a fluorescent probe that forms highly fluorescent complexes with Ca^{2+} and Mg^{2+} ions bound to membranes. Acini, preloaded by incubation with CTC (100 μM), displayed a fluorescence having spectral properties like that of CTC complexed to calcium (excitation and emission maxima at 398 and 527 nm, resp.). Stimulation with either bethanechol (100 μM) or cerulein (10 ng/ml) resulted in a rapid loss of fluorescence intensity and an increase in outflux of CTC from the acini. After 5 min of stimulation, acini fluorescence was reduced by 40% and appeared to be that of CTC complexed to Mg^{2+} (excitation and emission maxima at 393 and 521 nm, resp.). The fluorescence loss induced by bethanechol was blocked by atropine (5 μM) and was seen at all agonist concentrations that elicited amylase release. Maximal fluorescence loss, however, required a bethanechol concentration three times greater than that needed for maximal amylase release. In contrast, acini preloaded with 1-anilino-8-naphthalenesulfonate or oxytetracycline displayed no secretagogue-induced fluorescence changes. These results support the hypothesis that CTC is able to probe some set of intracellular membranes that release calcium during secretory stimulation and that this release results in dissociation of Ca^{2+}-complexed CTC.

3600 MORPHOLOGICAL CHANGES IN RAT PANCREATIC SLICES ASSOCIATED WITH INHIBITION OF ENZYME SECRETION BY HIGH CONCENTRATIONS OF SECRETAGOGUES. (Eng.) Savion, N.; Selinger, Z. (Hebrew Univ. Jerusalem, Jerusalem, Israel). *J. Cell Biol.* 76(2):467-482; 1978.

The morphological and biochemical characteristics of the inhibition of enzyme secretion seen with high concentrations of secretagogues were examined. Stimulation of enzyme secretion in rat pancreatic slices by cholinergic agonists or by cholecystokinin-pancreozymin (CCK-PZ) and its peptide analogs showed a biphasic dose response curve. The optimal concentrations eliciting an efficient rate of enzyme secretion were 1 μM for carbamylcholine or acetylcholine, and 5 nM and 20 nM for CCK-PZ octapeptide and CCK-PZ, resp. At higher concentrations of secretagogues, however, the rate of secretion progressively declined, and almost complete inhibition was achieved at 1 mM of carbamylcholine or acetylcholine and at 0.1 μM of CCK-PZ or its octapeptide analog. Atropine displaced the dose-response curve for carbamylcholine to the right so that in the presence of 7 μM atropine a concentration of 1 mM carbamylcholine gave an optimal rate of enzyme secretion. The ionophore A-23187 did not relieve the inhibition caused by supraoptimal concentrations of secretagogues, indicating that the inhibition occurs at the cellular rather than at the receptor level. Secretin had no effect on the inhibition of enzyme secretion by a high concentration of carbamylcholine, indicating that the inhibition was not caused by lack of water and electrolyte secretion. The energy-producing metabolism was not affected, since the ATP level in the pancreatic slices was the same in the presence of either inhibitory or optimal concentrations of secretagogues. The inhibition of enzyme secretion was reversible because restoration of efficient enzyme secretion occurred after removal of carbamylcholine (1 mM) by washing, followed by addition of an optimal concentration of CCK-PZ octapeptide. Morphological studies revealed that the presence of inhibitory concentrations of secretagogues caused severe distortion of the lumen structure: disruption of the filamentous system surrounding the lumen, disappearance of microvilli, and production of distended evaginations of the luminal membrane containing cellular material. These changes eventually caused a reduction in the size of the lumen, which became plugged with secretory material. These changes in the microtubular microfilamentous system could account for the inhibition of enzyme secretion.

3601 ON THE SECRETAGOGUE EFFECT OF DIBUTYRYL CYCLIC AMP IN THE RAT EXOCRINE PANCREAS. (Eng.) Bauduin, H.; Stock, C.; Launay, J. F.; Vincent, D.; Potvliege, P.; Grenier, J. F. (Free Univ. Brussels, Lab. Biochemical Pharmacology, B-1000 Brussels, Belgium). *Pfluegers Arch.* 372(1): 69-76; 1977.

Since the implication of cyclic AMP in the action of physiological stimuli is questionable and cyclic AMP and dibutyryl cyclic AMP (DbcAMP) are known to have dissociated effects in various tissues or cell types, the secretagogue property of the nucleotide derivative on the exocrine pancreas was investigated more thoroughly in rats. DbcAMP at a concentration of 0.1 mM or greater induced the discharge of exportable enzymes from rat pancreas fragments incubated *in vitro*. This effect was seen to be quali-

tatively similar to the action of physiological secretagogues acting via hormone receptors in the following ways. It was accompanied by the appearance of exocytotic images at the acinar cell apex. It was energy dependent, but the energy supply was low, while that required for the carbamylcholine or cerulein response was high and could only be afforded by oxidative phosphorylation. It was calcium dependent, but no alteration of inward or outward calcium movement was observed. Lastly, it was altered by agents (e.g., cytochalasin B) previously shown to disrupt the microfilamentous microtubular system. However, the secretory response to DbcAMP was quantitatively less than that obtained with hormonal stimuli. A damaging effect of DbcAMP on pancreatic acinar cells was ruled out on histological and biochemical grounds: there was no significant leakage of LDH, and protein synthesis, and 2-deoxy-D-glucose and L-leucine uptake were unaltered. The secretagogue effect of DbcAMP was reversible, dose-related, and specific. It was not mediated by neurotransmitter release or by interaction with their receptors. The evidence points to a direct interaction of DbcAMP with the pancreatic acinar cell and suggests the last step of the secretory cycle as the most probable site of action of the nucleotide derivative.

3602 PANCREATIC EXOCRINE SECRETION IN ANESTHETIZED AND CONSCIOUS RATS. (Eng.) Petersen, H.; Grossman, M. I. (Veterans Admin. Wadsworth Hosp. Center, Los Angeles, CA 90073). *Am. J. Physiol.* 233(6):E530-E536; 1977.

Pancreatic secretion in response to graded doses of secretin and cholecystokinin was studied in conscious and anesthetized Sprague-Dawley rats. During the first 2 to 5 days after the pancreatic fistula was prepared, basal pancreatic volume and protein outputs increased markedly in the conscious rats, reaching levels more than 10 times greater than in anesthetized rats. Maximal bicarbonate output in response to secretin was more than four times greater in conscious than in anesthetized rats, but the maximal protein response to cholecystokinin was similar in the two states. In conscious rats, recirculation of bile plus pancreatic juice into the duodenum caused a significant decrease in bicarbonate and protein outputs (43% and 59% lower, resp.). Without recirculation, basal protein output was as high as the maximal response to cholecystokinin with recirculation and was not increased by exogenous cholecystokinin. The findings support the hypothesis that, unlike anesthetized rats, conscious rats have a high basal rate of spontaneous release of cholecystokinin and that this can be partially suppressed by recirculation of bile plus pancreatic juice. The responses of rats to secretin and cholecystokinin are greatly affected by the time that has elapsed since surgical preparation and by whether bile and pancreatic juice are recirculated into the gut.

3603 EFFECTS OF CHRONIC ALCOHOL ADMINISTRATION ON THE EXOCRINE PANCREATIC SECRETION OF THE CONSCIOUS RAT: A FOLLOW-UP STUDY. (Fre.) Laugier, R.; Sarles, H. (Unite de Recherches de Pathologie Digestive, INSERM U-31, 46, chemin de la Gaye, F 13009 Marseille, France). *Gastroenterol. Clin. Biol.* 1(10):767-774; 1977.

The effect of long-term alcohol consumption on basal exocrine pancreatic secretion and on secretion stimulated by the intraduodenal instillation of oleic acid was studied in adult male Sprague-Dawley rats. The animals received water *ad libitum* in which the alcohol content was increased from 5 to 20% over a 3-week period and maintained at 20% during the rest of the experiment (4, 8, or 12 months total length). Control rats received normal drinking water. Water and bicarbonate secretions were decreased at the 4th month of chronic alcohol consumption, but then returned to normal. However, protein secretion (both concentration and output) was increased at the beginning of the 4th month. In the 8th month, the basal protein output in the treated rats was more than twice as high as in the controls, and it could no longer be stimulated by intraduodenally administered oleic acid. The protein secretion seemed to have spontaneously reached its maximum. During the 12th month, the basal protein secretion in the treated rats was significantly lower than in the controls, and it was still not stimulated by oleic acid. This phenomenon could be explained by the progression of chronic pancreatic lesions that reduce the maximum secretory capacity of a hyperfunctioning pancreas. The findings indicate that chronic alcoholism at first reduces the basal and stimulated bicarbonate secretion, which phenomenon is then followed by changes in enzyme secretion. The increased protein secretion is the steadiest sign, before the onset of pancreatic insufficiency, of the effect of chronic alcoholism on the pancreas.

3604 THE EFFECT OF CHRONIC ETHANOL INGESTION ON THE PANCREATIC PROTEOLYTIC ENZYMES AND THEIR INHIBITORS IN THE RAT. (Eng.) Jalovaara, P.; Huttunen, R. (Dept. Anatomy, Univ. Oulu, 90220 Oulu 22, Finland). *Scand. J. Gastroenterol.* 12(7): 786-792; 1977.

The effect of chronic ethanol ingestion on pancreatic proteinases and their inhibitors, as well as some routinely assessed indices of pancreatic activity, were studied in 19 young inbred Long Evans male rats and 16 control animals. Ethanol (20% weight/volume, 1.1 ml/100 g of body weight) was administered by gastric intubation 5 times/week for 10-12 weeks. The general condition of animals, body weight gain, and the serum levels of hepatic transaminases did not change; the serum cholesterol level and the amount of trypsinogen, chymotrypsinogen, and specific and total casein hydrolizing activities in pancreatic homogenates did not differ significantly between the experimental and control groups. The activities of plasma enzymes commonly used as indicators of hepatic cell injury showed no difference between the control and experimental groups. Levels of blood amylase and serum triglycerides, the amount of soluble proteins in the homogenates, the specific and total BAPNA (*N*-alpha-

benzoyl-DL-arginine-4-nitroanilide-hydrochloride) hydrolyzing activities, and the total ATEE (*N*-acetyl-L-tyrosine ethyl ether) hydrolyzing activity were lower in the rats subjected to alcohol administration than in controls ($p<0.05$, $p<0.001$, $p<0.001$, $p\leq0.01$, $p\leq0.001$, and $p\leq0.01$, resp.). The trypsin inhibition of the homogenates was more pronounced and the plasma protein content was higher ($p<0.05$) in ethanol-treated rats, but the trypsin-inhibiting and trypsin-protecting capacities of the plasma were lower in the experimental group than in controls ($p\leq0.01$ and $p\leq0.001$). The results suggest that chronic ethanol ingestion in rats impairs protein synthesis in the pancreas leading to atrophy that corresponds to the clinical picture of chronic pancreatitis. Simultaneously, the protection mechanism of the blood against proteolytic enzymes is also impaired.

3605 INFLUENCE OF GLUCAGON ON EXOCRINE PANCREATIC FUNCTION AS DETERMINED BY THE LUNDH TEST IN DOGS. (Eng.) Gyr, K.; Kayasseh, L.; Stalder, G. A.; Rittmann, W. W.; Girard, J. (Kantonsspital, CH-4004 Basel, Switzerland). *Am. J. Vet. Res.* 38(12):1949-1952; 1977.

To standardize the Lundh test in dogs and to assess the extent to which the results are modified by glucagon administration, exocrine pancreatic function was investigated by the Lundh test in dogs with chronic duodenal and gastric fistulas. The mean tryptic activity detected in 18 tests in six dogs was 32.25 ± 5.25 μEqH+/min/ml, which is considerably higher than that observed in man. The administration of glucagon (5 or 10 μg/kg, i.v.) was followed at 30-60 min by a significant decrease (30.8%, $p<0.05$) in the volume of the duodenal contents and a more pronounced depression of the enzyme concentrations (trypsin 59%, chymotrypsin 53.3%, $p<0.02$). It is concluded that the Lundh test affords a valuable experimental model for the investigation of exocrine pancreatic function in dogs.

3606 METHADONE BLOCKADE OF 2-DEOXYGLUCOSE-INDUCED PANCREATIC SECRETION IN THE RAT: EVIDENCE FOR A CENTRAL SITE OF ACTION. (Eng.) Roze, C.; Chariot, J.; de La Tour, J.; Souchard, M.; Vaille, C.; Debray, C. (Hopital Bichat, 170 Blvd. Ney, 75877 Paris Cedex 18, France). *Gastroenterology* 74(2, Part 1):215-220; 1978.

The effects of methadone on pancreatic exocrine secretions were tested in male Wistar rats under basal conditions and following hormonal stimulation by secretin (0.125 U/kg/min) and cerulein (110 and 330 ng/kg) or after stimulation by the differentially acting cholinergic agents acetylcholine, 2-deoxyglucose, and electrical stimulation of the vagus. Methadone (2.5 or 5 mg/kg, s.c.) had no effect on basal hydroelectrolytic secretion. It decreased basal enzyme secretion very slightly. The stimulatory effects of 2-deoxyglucose (75 mg/kg, i.v.) were completely blocked by methadone at 5 mg/kg, and this blockade was reversed by nalorphine at 6 to 9 mg/kg. At 100 μg, methadone blocked 2-deoxyglucose effects when injected into brain ventricles, but the same dose was ineffective when systemically introduced. The effects of secretin, cerulein, acetylcholine, and electrical stimulation of the vagus were not depressed by methadone. These results strongly suggest that the methadone blockade of 2-deoxyglucose effects occurs at a central level and is mediated by narcotic drug receptors.

3607 EFFECT OF A SYNTHETIC ANALOGUE OF PGE_2 ON EXOCRINE AND ENDOCRINE PANCREATIC FUNCTION IN THE RAT. (Eng.) Dodi, G.; Santoro, M. G.; Jaffe, B. M. (Washington Univ. Sch. Medicine, St. Louis, MO 63110). *Surgery* 83(2):206-213; 1978.

The effect of 16,16-dimethyl prostaglandin E_2-methyl-ester (di-M-PGE_2) on exocrine and endocrine pancreatic secretion was studied in male Lewis rats with chronic pancreatic fistulas. Under basal conditions as well as after stimulation with secretin and cholecystokinin octapeptide (OP-CCK), pancreatic exocrine secretion was markedly inhibited by the i.v. injection of di-M-PGE_2 at 10 μg/kg and 100 μg/kg. Secretory volumes and bicarbonate and protein outputs decreased within 10 min after the administration of di-M-PGE_2, and this inhibitory effect persisted throughout the following 40 min. The smaller dose of di-M-PGE_2 (10 μg/kg, PG-10) inhibited the volume of pancreatic secretion by an average of 47.7% and decreased bicarbonate and protein output by 41.1% and 70.5%, resp. The larger dose (100 μg/kg, PG-100) caused a mean 48.3% inhibition of pancreatic secretory volume and decreased bicarbonate and protein outputs by 41.7% and 64.5%, resp. Plasma insulin levels were lowered markedly after injection of di-M-PGE_2 under basal conditions (mean inhibition 63.1% by PG-10 and 55.3% by PG-100) as well as after secretin stimulation (mean inhibition 89.5% by PG-10 and 82.4% by PG-100). These observations document that di-M-PGE_2 is a potent inhibitor of pancreatic exocrine and endocrine function in unanesthetized rats. The PGE_2-analogue antagonized the stimulatory effects of both secretin and OP-CCK.

3608 EFFECT OF PANCREATIC DUCT LIGATION ON EXOCRINE PANCREATIC FUNCTION AND STRUCTURE IN THE RABBIT. (Eng.) Arvanitakis, C.; Folscroft, J. (Kansas Univ. Sch. Medicine, Kansas City, KS 66103). *Experientia* 15(1):77-79; 1978.

The effect of pancreatic duct ligation, which is used as an experimental model of pancreatic insufficiency, on exocrine pancreatic function and structure was studied in the rabbit. Four weeks after pancreatic duct ligation, fecal and luminal chymotrypsin were detected in concentrations similar to those in sham-operated controls. Pancreatic changes in the ligated group included marked dilatation of the main pancreatic duct, proliferation and distention of ductules, and fibrosis. Despite pancreatic duct ligation and fibrosis, proteolytic enzymes continued to secrete into the duodenal lumen. These results suggest that pancreatic duct ligation in the rabbit is not associated with total pancreatic insufficiency.

3609 THE EFFECT OF INTRAVENOUS ACETALDEHYDE ON EXOCRINE PANCREATIC FUNCTION [Abstract]. (Eng.) Andersen, B. N.; Demol, P.; Sarles, H. (INSERM 46, chemin de la Gaye, 13009 Marseille, France). *Ir. J. Med. Sci.* 146(Suppl. 1):4-5; 1977.

3610 IN VITRO STIMULATION OF L-LEUCINE-4,5-^{3}H INCORPORATION AND ENZYME SECRETION OF THE RAT PANCREAS BY CLANOBUTINE [Abstract]. (Eng.) Hotz, J.; Fahlbusch, V.; Goebell, H. (Medical Clinic, Univ. Essen, Essen, W. Germany). *Ir. J. Med. Sci.* 146(Suppl. 1):4; 1977.

3611 ETHANOL: METABOLISM AND ACTION ON PROTEIN SYNTHESIS AND SECRETION IN THE RAT PANCREAS [Abstract]. (Eng.) Clemente, F.; Estival, A.; Ribet, A. (INSERM U 151, C.H.U. Rangueil, 31052 Toulouse, France). *Ir. J. Med. Sci.* 146(Suppl. 1): 4; 1977.

3612 INVOLVEMENT OF TWO ENZYMATIC POOLS OF DIFFERENT COMPOSITION AND SIZE IN RAT PANCREATIC SECRETION [Abstract]. (Eng.) Dagorn, J. C.; Michel, R.; Figarella, C.; Sarles, H. (Unite 31 INSERM, 46 chemin de la Gaye, 13009 Marseille, France). *Ir. J. Med. Sci.* 146(Suppl. 1): 3-4; 1977.

3613 INTERACTION BETWEEN SECRETIN AND DOPAMINE ON CYCLIC AMP TISSUE LEVELS IN THE RAT PANCREAS [Abstract]. (Eng.) Vaysse, N.; Esteve, J. P.; Brenac, B.; Moatti, J. P.; Pascal, J. P. (INSERM U 151, C.H.U. Rangueil, 31052 Toulouse, France). *Ir. J. Med. Sci.* 146(Suppl. 1):7; 1977.

3614 THE EXOCRINE PANCREATIC SECRETION AND IMMUNOREACTIVE SECRETIN (IRS) RELEASE AFTER INTRADUODENAL INSTILLATION OF BILE IN MAN [Abstract]. (Eng.) Osnes, M.; Hanssen, L. E.; Flaten, O.; Myren, J. (Ulleval Hosp., Oslo 1, Norway). *Ir. J. Med. Sci.* 146(Suppl. 1):8; 1977.

3615 SOMATOSTATIN (SRIF) INHIBITS PANCREATIC ENZYME SECRETION AND GALLBLADDER EMPTYING CAUSED BY INTRALUMINAL DIGESTIVE PRODUCTS AND EXOGENOUS CHOLECYSTOKININ (CCK) IN MAN [Abstract]. (Eng.) Holtermuller, K. H.; Schittelkop, G.; Schulmerich, H. (Medizinische Klinik, Langenbeckstr. 1, 65 Mainz, W. Germany). *Ir. J. Med. Sci.* 146 (Suppl. 1):14; 1977.

3616 UPTAKE AND EXCHANGE OF $^{15}Ca^{2+}$ WITH ISOLATED PANCREATIC ACINI [Abstract]. (Eng.) Poulsen, J. H.; Williams, J. A. (Dept. Physiology, Univ. California, San Francisco, CA). *Ir. J. Med. Sci.* 146(Suppl. 1):5; 1977.

3617 EFFECT OF PGE_2 ON THE STIMULATED EXOCRINE PANCREATIC SECRETION IN MAN [Abstract]. (Eng.) Angelini, G.; Cavallini, G.; Rosa, B.; Bertini, C.; Adamo, S.; Zuniga, G.; Scuro, L. A. (Clinica Medica III, Verona, Italy). *Ir. J. Med. Sci.* 146(Suppl. 1):9; 1977.

3618 CALCIUM BINDING TO RAT PANCREAS MICROSOMAL MEMBRANES [Abstract]. (Eng.) Argent, B. E.; Case, R. M.; Hirst, F. C.; Scott-Wilson, C. J. (Univ. Medical Sch., Newcastle upon Tyne NE1 7RU, England). *J. Physiol. (Lond.)* 273(2):69P-70P; 1977.

3619 THE EXOCRINE PANCREATIC SECRETION AND IMMUNOREACTIVE SECRETIN (IRS) RELEASE AFTER INTRADUODENAL INSTILLATION OF BILE IN MAN [Abstract]. (Eng.) Osnes, M.; Hanssen, L. E.; Flaten, O.; Myren, J. (Ulleval Hosp., Oslo, Norway). *Scand. J. Gastroenterol.* 12(Suppl. 45):67; 1977.

3620 NONPARALLEL PANCREATIC SECRETION IS NOT NECESSARILY INDUCED BY ENZYME-SPECIFIC HORMONES [Abstract]. (Eng.) Dagorn, J. C.; Estival, A. (INSERM U 31, 13009 Marseille, France). *Digestion* 16(1/2):208; 1977.

3621 PANCREATIC EFFECTS OF MAJOR RESECTIONS OF SMALL INTESTINE IN THE RAT [Abstract]. (Eng.) Germain, M.; Gremillet, C.; Avci, C. (Hopital de Vaugirard, 389 rue de Vaugirard, 75015 Paris, France). *Ir. J. Med. Sci.* 146(Suppl. 1): 48-49; 1977.

3622 THE EFFECT OF ETHANOL AND ACETALDEHYDE ON EXOCRINE PANCREATIC FUNCTION IN NORMAL AND CHRONIC ALCOHOLIC RATS [Abstract]. (Eng.) Demol, P.; Andersen, B. N.; Sarles, H. (INSERM U 31, 46 Chemin de la Gaye, 13009 Marseille, France). *Ir. J. Med. Sci.* 146(Suppl. 1):48; 1977.

3623 IN VIVO AND IN VITRO EVIDENCE FOR A DIRECT EFFECT OF BOMBESIN AND LITORIN ON THE RAT PANCREAS [Abstract]. (Eng.) Adler, M.; Deschodt-Lanckman, M.; Robberecht, P.; Christophe, J. (Free Univ. Brussels Medical Sch., Brussels, Belgium). *Ir. J. Med. Sci.* 146(Suppl. 1):22; 1977.

3624 COMPARISON OF THE RESPONSE OF PANCREATIC ENZYMES TO EXOGENOUS PANCREOZYMIN AND THE LUNDH-BORGSTROM MEAL [Abstract]. (Eng.) Sandle, G. I.; Herman, K.; Hine, P.; Kay, G.; Braganza, J. M. (Royal Infirmary, Manchester, England). *Ir. J. Med. Sci.* 146(Suppl. 1):44; 1977.

3625 EFFECTS OF SYNTHETIC PROSTAGLANDIN ON PANCREATIC EXOCRINE FUNCTION IN THE CONSCIOUS RAT [Abstract]. (Eng.) Bourry, J.; Demol, P.; Sarles, H. (INSERM Unite 31, 46 chemin

de la Gaye, 13009 Marseille, France). *Ir. J. Med. Sci.* 146(Suppl. 1):44; 1977.

3626 CHANGES OF PANCREATIC SECRETION BY COLLECTION THROUGH DUODENOSCOPIC CATHETERS [Abstract]. (Eng.) Lawaets, O.; Henriksen, F. W.; Worning, H. (Inst. Experimental Res. in Surgery, Copenhagen, Denmark). *Ir. J. Med. Sci.* 146(Suppl. 1):45; 1977.

3627 THE EFFECT OF PARTIAL PANCREATECTOMY IN RATS [Abstract]. (Eng.) Pearson, K. W.; Scott, D.; Torrance, H. B. (Manchester Royal Infirmary, Manchester, England). *Ir. J. Med. Sci.* 146 (Suppl. 1):45-46; 1977.

3628 PANCREATIC TRANSPLANTATION IN THE RAT [Abstract]. (Eng.) Germain, M.; Gremillet, C. (Hopital Henri Mondor, 94000 Creteil, France). *Ir. J. Med. Sci.* 146(Suppl. 1):46; 1977.

3629 SIMULTANEOUS STIMULATION OF PANCREATIC AND BILIARY SECRETION BY INTRA-DUODENAL AND INTRA-JEJUNAL PERFUSION OF BILE SALTS IN CATS [Abstract]. (Eng.) Eisenhardt, J. M.; Hotz, J.; Ormai, S.; Schneider, F.; Hartmann, W.; Aufgebauer, J.; Goebell, H. (Medical Clinic, Univ. Essen, Essen, W. Germany). *Ir. J. Med. Sci.* 146(Suppl. 1):47; 1977.

See also, 3541, 3773, 3803, 3849.

SECRETION AND METABOLISM

Hepatobiliary Tract

3630 RAT HEPATOCYTE PRIMARY CELL CULTURES. III. IMPROVED DISSOCIATION AND ATTACHMENT TECHNIQUES AND THE ENHANCEMENT OF SURVIVAL BY CULTURE MEDIUM. (Eng.) Williams, G. M.; Bermudez, E.; Scaramuzzino, D. (American Health Foundation, 1 Dana Rd., Valhalla, NY 10595). *In Vitro* 13(12): 809-817; 1977.

Techniques for dissociation and attachment of rat hepatocytes as well as modifications of the culture medium that enhance *in vitro* survival of the cells are described. The 4-min washout perfusion of livers from adult male Fisher rats was performed with 0.5 mM ethylene glycol-bis-(β-amino ethyl) *N,N'*-tetracetic acid in Ca^{++}-Mg^{++}-free Hank's balanced salt solution buffered with 0.05 M *N*-2-hydroxyethyl-piperazine-*N'*-2-ethanesulfonic acid (HEPES) to pH 7.2. The 10- to 12-min enzyme perfusion was performed with collagenase solution (100 U/ml) in Williams' medium E (WE) buffered to pH 7.4 with 0.05 M HEPES, and during it, the flow rate was decreased gradually from 40 to 20 ml/min. Following perfusion, cells were detached by combing into fresh collagenase solution, centrifuged at 50 x *g* for 4 min, resuspended with a 25 ml wide-mouthed pipette, and inoculated into 25 cm^2 plastic flasks in 5.0 ml of WE with 10% fetal bovine serum and 50 μg/ml gentamicin. The attachment interval lasted 1.5 hr to permit attachment only of viable cells. The effect of four culture media (Eagle's Minimum Essential Medium, Leibovitz's L-15, Ham's F-12, and a newly formulated medium containing galactose) on attachment and survival of cells was studied. Reduction of the perfusion rate decreases the amount of collagenase solution required. Gradual reduction of the flow rate of the enzyme perfusion did not alter the viability or yield, but preserved the histology of the liver and decreased the amount of collagenase solution required. Dissociation in enzyme solution increased the viability of the final suspension to 69 ± 16% in comparison with 38 ± 17% after dissociation in WE. Postdissociation enzyme exposure (15 min in collagenase and hyaluronidase) reduced the recovery of viable cells from 100 to 64 ± 31% and the attachment efficiency from 30 ± 11 to 11 ± 11% ($p<0.01$) and thus is not recommended. When all the tested procedures were combined into the described modified method, the average percentage of free nuclei decreased (40-10%), the viable cells recovered (92 ± 53 x 10^6 to 164 ± 70 x 10^6 cells/100 g body weight), the percentage of viable cells increased (43 ± 15 to 79 ± 7%), and the percentage of attachment efficiency increased (25 ± 9 to 42 ± 11%). The volume of medium present during attachment was a critical factor: the 5-ml volume gave a 50% attachment efficiency compared to a 20% attachment efficiency in a 2-ml volume. Additional investigations indicated that the effect was due to enhanced viability of unattached cells in the larger volume environment and not due to dilution of any residual collagenase. Eagle's medium, WE, L-15, and F-12 supported culture survival to similar extents, although average survival in L-15 appeared slightly better than in the others; the newly-formulated,

galactose-containing medium was comparable to L-15 in this respect. The improved conditions described enhance the final recovery of viable liver cells and the attachment efficiency of liver cells *in vitro*.

3631 EVALUATION OF HEPATOCELLULAR AND KUPFFER CELL FUNCTION OF THE ISOLATED GUINEA PIG LIVER PERFUSED BY A FLUOROCARBON MEDIUM. (Eng.) Roeser, H. P.; Cooksley, W. G. E.; Mack, S. (Royal Brisbane Hosp., Herston, Brisbane, 4029, Queensland, Australia). *Gastroenterology* 74(2, Part 1):209-214; 1978.

A synthetic medium for isolated guinea pig liver perfusion, using a fluorocarbon (FC) emulsion as the oxygen-carrying agent, was evaluated for its capacity to maintain liver viability and function. A 10% emulsion of perfluorotributylamine (FC43) was dispersed by a nonionic detergent (Pluronic F68) in a buffered electrolyte solution. The FC43 perfusate was compared with identical media in which FC43 was either omitted or replaced by 20% isologous RBC. Damage to liver cells was assessed by hepatic flow rate, aspartate aminotransferase release, and liver histology. Bile secretion, albumin synthesis, and galactose elimination capacity were used as indices of parenchymal cell function, and Kupffer cell activity was assessed by uptake of colloidal radioactive gold. All three perfusion media satisfactorily maintained liver cell viability, but the two media supplemented with a specific oxygen-carrying agent were associated with significantly superior parenchymal cell function ($p=0.05-0.01$). The performance of the FC and RBC media was not significantly different. The phagocytic activity of Kupffer cells was well sustained by all three media, but the FC medium was superior with large amounts of colloidal gold. Iron release from hepatic parenchymal cells, with the FC medium, was similar to that reported for rat liver preparations, using a RBC perfusate.

3632 HEPATIC CLEARANCE OF DRUGS. III. ADDITIONAL EXPERIMENTAL EVIDENCE SUPPORTING THE "WELL-STIRRED" MODEL, USING METABOLITE (MEGX) GENERATED FROM LIDOCAINE UNDER VARYING HEPATIC BLOOD FLOW RATES AND LINEAR CONDITIONS IN THE PERFUSED RAT LIVER IN SITU PREPARATION. (Eng.) Pang, K. S.; Rowland, M. (Natl. Inst. Health, Bethesda, MD 20014). *J. Pharmacokinet. Biopharm.* 5(6):681-699; 1977.

The disposition of the lidocaine metabolite, monoethylglycine xylidide (MEGX), was studied in a perfused rat liver *in situ* preparation in an attempt to discriminate further between two models of hepatic drug clearance. In the "well-stirred" model, the liver is regarded as a well-stirred compartment with the emergent drug concentration in equilibrium with that in the liver. In the "parallel tube" model, the liver is viewed as a series of identical parallel units with enzymes distributed evenly around the units. Using a single passage perfusate system, it was found in a previous study that the extraction ratio of lidocaine was maximal and constant (0.997) below 7 mg/l. The steady-state output MEGX concentration appearing in the emergent blood upon a constant and low input concentration of lidocaine (4 mg/l) was determined under varying hepatic blood flow rates (10-16 ml/min/liver). The data suggest that, operationally, the well-stirred model adequately describes the appearance of MEGX from lidocaine.

3633 MASSIVE LIVER ENLARGEMENT ACCOMPANIED BY DECREASED DRUG METABOLISM. EFFECT OF ANTERIOR PITUITARY EXTRACT ON HEPATIC ULTRASTRUCTURE, ZOXAZOLAMINE PARALYSIS, AND METABOLISM IN THE RAT. (Eng.) Szabo, S.; Garg, B. D.; Kourounakis, P.; Tuchweber, B. (Harvard Medical Sch., Boston MA 02115). *Can. J. Physiol. Pharmacol.* 55(5):1135-1142; 1977.

The relationship between liver enlargement and drug metabolism was investigated in female Sprague-Dawley rats. Hepatomegaly (e.g., 31% increase in liver weight in a 17-day experiment) was induced by injection of lyophylized anterior pituitary (LAP) extract (20 mg, s.c. twice daily for 4-34 days). The liver enlargement seemed to be due to an increase in the number and the size (enhanced water content and PAS-positive material) of hepatocytes. Electron microscopy of the liver revealed slight proliferation of the smooth endoplasmic reticulum and pronounced fragmentation and dilation of the rough endoplasmic reticulum. Zoxazolamine paralysis time was significantly prolonged (+55% and +102%) after 4 and 17 days, resp., of treatment with LAP. Metabolism of zoxazolamine by the 9,000 x *g* supernatant fraction of the liver of rats given LAP for 17 days was reduced by 73%. Thus, the marked hepatomegaly induced by LAP was associated with a prolonged action of the drug, which may result from a decrease in hepatic drug metabolism.

3634 CHOLERESIS AND HEPATIC TRANSPORT MECHANISMS. III. BINDING OF OUABAIN AND K-STROPHANTHOSIDE TO BILIARY MICELLES AND INFLUENCE OF CHOLERESIS ON THEIR BILIARY EXCRETION. (Eng.) Vonk, R. J.; Van Doorn, A. B. D.; Scaf, A. H. J.; Meijer, D. K. F. (Dept. Pharmacology, State Univ. Groningen, Bloemsingel 1, Groningen, Netherlands). *Naunyn Schmiedebergs Arch. Pharmacol.* 300(2):173-177; 1977.

To investigate binding of drugs to biliary micelles as a possible factor in the hepatic transport process, the interaction of two uncharged compounds, ^{3}H-ouabain and ^{3}H-K-strophanthoside with biliary micelles was studied by ultracentrifugation of rat bile. The bile acids normally present in rat bile were predominantly associated with cholesterol-containing micelles, but not to the same extent. The tendency of the bile salts to be associated with mixed micelles was the greatest for conjugated chenodeoxycholate, lower for conjugated deoxycholate, and the least for conjugated cholate. The sedimentation patterns of the water soluble

cardiac glycosides, added *in vitro*, indicated binding to mixed biliary micelles as well as noncholesterol-containing micelles. Mannitol was found to be associated with both categories of biliary micelles. In spite of the binding of cardiac glycosides to the micelles, the administration of taurocholate did not stimulate biliary output of the glycosides. The administration of the choleretics dehydrocholate and ethacrynic acid failed to enhance biliary output of the glycosides. These results indicate that binding of drugs to biliary micelles diminishes the free concentration of drugs in bile and confirm earlier studies with organic anions that binding to biliary micelles is not a pertinent factor in the rate of biliary excretion.

3635 BILE-SALT-DEPENDENT AND INDEPENDENT CHOLERESIS INDUCED BY BUCOLOME IN THE RAT. (Eng.) Kitani, K.; Morita, Y.; Miura, R.; Kanai, S. (Tokyo Metropolitan Inst. Gerontology, 35-2, Sakaecho, Itabashi-ku, Tokyo 173, Japan). *Can. J. Physiol. Pharmacol.* 55(5):1155-1161; 1977.

The bile salt pool was studied in male Wistar rats in which choleresis was induced by 1-cyclohexyl-5-*n*-butyl-2,4,6-trioxoperhydropyrimidine (bucolome, BC). The rats received BC (20 mg/100 g) i.p. [^{14}C]erythritol and mannitol clearance studies indicated that this choleresis was of canalicular origin. In 1-hr continuous bile collection studies, immediately after the interruption of enterohepatic circulation (acute interruption), the bile flow rate was considerably increased and the bile salt excretion rate was significantly increased ($p<0.05$) in rats that received BC. However, the bile salt excretion rate fell rapidly in BC-administered rats, while the bile flow rate was fairly constant during this 1-hr period. Thus, unlike the situation in control rats, bile flow rate was not significantly correlated with the bile salt excretion rate in BC-administered rats. In rats that had an external bile fistula open for 16-20 hr (chronic interruption of enterohepatic circulation), the bile flow rate was also significantly increased ($p<0.01$) by BC administration, while the bile salt excretion rate was not changed after BC administration. It is suggested that BC induced bile salt-independent choleresis in both experimental rat groups (acute and chronic interruption of enterohepatic circulation). In addition, BC appeared to increase the bile salt-dependent fraction of bile in rats with acute interruption of enterohepatic circulation, possibly by mobilizing the bile salt pooled in the intestinal content and/or intestinal wall.

3636 CHARACTERIZATION OF METHYLUMBILLIFERONE (MENDIAXON®)-INDUCED CHOLERESIS IN THE ISOLATED PERFUSED RAT LIVER. (Eng.) Kroker, R.; Anwer, M. S.; Hegner, D. (Fachbereich Tiermedizin, Univ. Munchen, Veterinarstr. 13, D-8000 Munchen 22, W. Germany). *Acta Hepatogastroenterol.* 24(5):348-354; 1977.

Studies were performed on isolated perfused livers from male Wistar rats to characterize the influence of the choleretic drug, methylumbilliferone, on bile formation. In experiments on the time-dependent influence of methylumbilliferone (10 mg/liver), the drug increased bile acid secretion (from 34 to 61 nmol/g liver), bile flow (from 14.8 to 28 µl/g liver), and sodium excretion (from 2.5 to 5.0 µmol/g liver), all within 20 min of the addition of the drug. Bile acid secretion decreased to 3.5 nmol/g liver by 100 min after addition of the drug (60 min of perfusion), compared to a value of 14 nmol/g in controls at this time. Methylumbilliferone was shown not to affect the assay used for bile acid estimation. The dose-dependent effect of methylumbilliferone on bile flow and bile acid secretion was examined. The maximal effect was observed at a final concentration of 1.13 mM, resulting in a 110% increase of bile flow and a 150% increase in bile acid secretion; concentrations below 5.6 mM did not alter either parameter. The erythritol clearance rate was measured before and after the administration of methylumbilliferone and plotted against bile flow, yielding a slope of essentially 1 in both cases. This result indicates that all the bile is of canalicular origin. Calculation of the relative increases of sodium excretion and bile flow yielded a significantly correlated ($r=0.99$) regression line, which indicates that the increased bile flow was due in part to the elevated sodium excretion. Analysis of the bile for the hydrolyzed drug demonstrated that the increased bile flow was also due in part to the excreted portion of methylumbilliferone. These results indicate the complexity of hepatic organic anion excretion.

3637 THREE METHODS FOR MEASURING THE INCREASE IN THE CAPACITY OF THE DISTENDED BILIARY TREE IN THE RAT PRODUCED BY α-NAPHTHYLISOTHIOCYANATE TREATMENT. (Eng.) Olson, J. R.; Fujimoto, J. M.; Peterson, R. E. (Medical Coll. Wisconsin, Wilwaukee, WI 53233). *Toxicol. Appl. Pharmacol.* 42(1):33-43; 1977.

As one step in attempting to understand structure-function relationships, studies aimed at measuring one structural feature were undertaken. The capacity of the distended biliary tree was measured in male Sprague-Dawley rats by three techniques: retrograde intrabiliary injection (RII), segmented retrograde intrabiliary injection (SRII), and retrograde pushback (RPB). Biliary tree distention was produced by the administration of α-naphthylisothiocyanate (ANIT, 45 mg/kg/day) in olive oil by gavage for 8 days. Control rats, which received 0.2 ml of olive oil daily for 8 days, had distended capacities of 33.4 ± 2.7, 34.1 ± 3.4, and 31.6 ± 2.9 µl by the RII, SRII, and RPB techniques, resp., at 15 days after the treatment. In treated rats, the RII, SRII, and RPB techniques gave distended biliary capacities of 48.0 ± 1.6, 47.5 ± 1.4, and 46.8 ± 1.3 µl, resp. In controls, the two-way analysis of variance showed no significant difference between the three methods. For each of the three methods, the mean distended biliary tree capacity of the ANIT-treated rats was significantly greater than the control rats ($p<0.02$). No significant difference was found between control

and ANIT-treated rats for mean liver weights and biliary capacity with ANIT treatment was not accompanied by any change in liver weight or bile flow rate.

3638 ROLE OF KUPFFER CELLS AND SUPPRESSOR T CELLS IN THE GRAFT VERSUS HOST REACTION AFTER INTRAHEPATIC LYMPHOID TISSUE IMPLANTATION. (Eng.) Vuitton, D.; Eloy, R.; Clendinnen, G.; Grenier, J. F. (Unit Surgical Res. and Biophysiopathology of the Intestine, Ave. Moliere, 67200 Strasbourg/Hautepierre, France). *Cell. Immunol.* 34(1):138-145; 1977.

Semiallogeneic lymph nodes were implanted into the livers of August (AgB_3) x Lewis (AgB_1) rats to study the roles of Kupffer cells and suppressor thymus-derived lymphocytes (T cells) in the immunosuppressive function of the liver during the graft-versus-host (GVH) reaction. In some animals, suppressor T cells were impaired by adult thymectomy 10 weeks before the induction of GVH reaction, and, in others, blockade of Kupffer cells was achieved by the injection of colloidal substrate at the time of antigen recognition; thus the effects of each type of cell on immunosuppressive function of the liver were studied separately. The development of a severe clinical GVH reaction and a near-50% mortality between the 4th and 10th postoperative days among thymectomized rats showed that the protective role played by the liver in the reaction to intrahepatic implantation of semiallogeneic lymphoid tissue is severely impaired by thymectomy 10 weeks prior to implantation. In contrast, impairment of the function of Kupffer cells by gelatin uptake did not result in a lethal GVH reaction. Histological changes observed in the spleen of thymectomized rats included cellular depletion of the white pulp and intense lymphoblastic proliferation in the red pulp 8 days after lymph node implantation. The cellular depletion of white pulp was still present at 15 days after implantation, while the cellular infiltration of the red pulp disappeared almost completely. Postmortem examination on the 6th day after lymph node implantation revealed severe lymphoid atrophy that might be related to the lethal GVH reaction. The results suggest that a subpopulation of the recipient's short-lived T cells is involved in the immunosuppressive function of the intact liver and that Kupffer cells are not an essential component of the protective mechanisms of the liver.

3639 HEPATIC BLOOD FLOW MEASUREMENT. (Eng.) Ńxumalo, J. L.; Teranaka, M.; Schenk, W. G., Jr. (Dept. Surgery, State Univ. New York at Buffalo, Buffalo, NY). *Arch. Surg.* 113(2):169-172; 1978.

A comparison was made between total hepatic blood flow measured by the single injection of indocyanine green (0.5 mg/kg) and the electromagnetic flow methods in the dog, in which circulatory overload was induced by dextran 40 infusion (2.0% of body weight over 30 min). While there was close correlation between the values obtained by the two methods in normal dogs, hepatic blood flow was overestimated by 40-60% by the indirect indocyanine green method following dextran infusion if the electromagnetic method was used as a comparison standard. One possible explanation for the puzzling finding that the total hepatic blood flow as measured by the indocyanine green clearance method was larger than that measured by the electromagnetic flow method may be that there was a decreased extraction ratio after dextran infusion.

3640 BLOOD FLOW IN NORMAL AND CHOLESTATIC DOG LIVER AS MEASURED BY INTRAPARENCHYMAL INJECTION OF XENON 133. (Eng.) Hall, C.; Bergan, A.; Henriksen, J. E. (Rikshospitalet, Langesgt., Oslo 1, Norway). *Eur. Surg. Res.* 9(5):357-363; 1977.

Parenchymal liver blood flow, as reflected by the washout of intraparenchymally injected ^{133}Xe, was studied at different stages of total cholestasis in the dog over a 3-week period. In three dogs, the gallbladder was removed and the common bile duct was divided between ligatures, resulting in total cholestasis. Three other dogs served as controls. In dogs subjected to total cholestasis, the median parenchymal liver blood flows measured after 1 hr, 7 days, 14 days, and 21 days of cholestasis were 53.2 (range, 40.4-67.5), 51.7 (range, 39.1-57.4), 59.3 (range, 49.2-71.9), and 51.7 (range, 30.3-77.6) ml/min/100 g liver tissue, resp., compared with median flow values in control dogs of 50.4 (range, 39.7-82.0), 41.0 (range, 34.0-54.2), 47.9 (42.9-63.1), and 45.4 (35.9-52.3) ml/min/100 g liver tissue, resp. The differences found between measurements obtained from cholestatic and normal dog livers were not statistically significant at any stage of the experiment. Thus cholestasis does not appear to influence parenchymal liver blood flow in the dog. Histograms of the results obtained from normal and cholestatic and normal dogs were plotted weekly, and it was concluded from these that cholestasis also does not influence the distributive pattern of the obtained flow values. However, the method applied in this experiment does not give information about blood flow through eventual anastomoses or about the relative contribution of the portal venous and the hepatic arterial system to the flow measured. The above results do not agree with most of the previously reported studies on parenchymal liver blood flow. The reason for the disparity may lie primarily in the variety of methods utilized and also in the lack of objective assessment of the actual cholestatic damage induced in different studies at various time intervals.

3641 CORRELATION BETWEEN XENON-133 RECTUM-TO-HEART TIME AND PORTAL VENOUS HEMODYNAMICS. (Eng.) Ludewig, R. M.; Castell, D. O. (Eastern Virginia Medical Sch., 600 Gresham Drive, Norfolk, VA 23507). *J. Surg. Res.* 24(2):92-96; 1978.

The relationship between portal venous resistance and the time in which ^{133}Xe is transported from

the rectum to the heart (RHT) was studied in dogs, to determine whether this marker could be used for evaluating the patency of surgically created portasystemic shunts. The RHT was determined in normal dogs (mean portal venous pressure [PVP]=9.3 cm H_2O), dogs with partially occluded portal veins (mean PVP, 25 cm H_2O), and dogs with totally occluded portal veins (mean PVP, 52 cm H_2O). During each incremental rise in PVP, the ^{133}Xe RHT increased significantly ($p<0.001$). The mean RHT in normal dogs rose from 74 to 250 sec when the portal vein was totally occluded. The results indicate that the ^{133}Xe RHT may be a useful parameter for determining the patency of surgically created portasystemic anastomosis. Further studies will be necessary to determine the effect of naturally occurring portasystemic shunts on the RHT and to support the validity of the test in the presence of developed collaterals.

3642 CLINICAL STUDY OF LIVER BLOOD FLOW IN MAN MEASURED BY ^{133}Xe CLEARANCE AFTER PORTAL VEIN INJECTION. (Eng.) Sherriff, S. B.; Smart, R. C.; Taylor, I. (Sheffield Royal Infirmary, England). *Gut* 18(12):1027-1031; 1977.

Liver blood flow was determined by ^{133}Xe clearance in 14 conscious patients with colorectal cancer, in whom the value of adjuvant liver perfusion of 5-fluorouracil was also being tested. Access to the portal circulation was achieved by dilatation and cannulation of the obliterated umbilical vein. The clearance from the liver of a bolus of ^{133}Xe was monitored using a gamma-ray camera so that blood flow from different areas of the liver could be calculated. The clearance curve of ^{133}Xe was a double exponential of which the initial fast component accounted for a consistently high proportion of the total clearance. The perfusion studies have shown wide differences in blood flow to the various areas of the liver in the same patient, in addition to a wide variation in perfusion rate between the 14 patients. This technique of quantitative estimations of liver blood flow to different areas of the liver may have importance in planning operative procedures and understanding the hemodynamic mechanisms involved in liver disease.

3643 HEPATIC VASCULATURE: A CONCEPTUAL REVIEW. (Eng.) Lautt, W. W. (Coll. Medicine, Univ. Saskatchewan, Saskatoon, Saskatchewan S7N OWO, Canada). *Gastroenterology* 73(5):1163-1169; 1977.

Information concerning the hepatic circulation is reviewed, with emphasis on the role of hepatic blood vessels in hepatic and homeostatic functions. Contrasts are made with resistance, capacitance, and fluid exchange functions in other better known vascular beds. Hemodynamic changes that produce shifts in fluid exchange in other tissues are without effect in the liver. Elevations of hepatic venous pressure are transferred quantitatively to the sinusoids and result in prolonged, massive fluid filtration into the abdominal cavity. Other factors that are involved with control of fluid exchange are discussed. The liver contains a large volume of blood that can be rapidly mobilized during hemorrhage. The hepatic circulation is highly sensitive to changes in circulating blood volume and serves as a major buffer for expanded or contracted blood volume. Control of hepatic blood flow and the reciprocal relationship between portal and hepatic arterial flow is discussed. Changes in hepatic blood flow produce marked changes in hepatic clearance rates of a wide variety of compounds. It is concluded that the hepatic artery is not controlled by local tissue metabolism but rather is controlled by a mechanism that tends to maintain hepatic blood flow (and therefore clearance rates) constant.

3644 THE EFFECT OF HYPERTONIC INFUSIONS ON HEPATIC BLOOD FLOWS AND LIVER VOLUME IN THE CAT. (Eng.) Lautt, W. W.; MacLachlan, T. L.; Brown, L. C. (Coll. Medicine, Univ. Saskatchewan, Saskatoon, Saskatchewan S7N OWO, Canada). *Can. J. Physiol. Pharmacol.* 55(6):1339-1344; 1977.

The effects of i.v. and intraportal infusions of hypertonic NaCl and glucose solutions on the resistance and capacitance vessels were studied in the intact feline liver. All doses infused produced vasodilation of the hepatic artery. A rough estimate would suggest that the tonicity changes equal to those seen after hemorrhage might produce an increase of arterial conductance to no less than 110% and no greater than 140% of control conductance. In response to i.v. infusions, portal flow increased to the same extent as did arterial flows. The resistance vessels were equally affected by equal osmolal loads of glucose or NaCl, but the hepatic volume changes were quite different depending on the substances infused. In marked contrast with the resistance vessel response to hypertonic NaCl, the hepatic capacitance vessels did not dilate. Liver volume decreased. Cessation of the infusion resulted in increases of hepatic volume to above control levels. Glucose produced consistent steady increases in volume that may have been associated with fluid uptake by the hepatocytes in conjunction with glucose uptake.

3645 THE EFFECT OF INCREASED INFERIOR VENA CAVA PRESSURE ON HEPATIC CIRCULATION IN THE DOG. (Eng.) Sugar, I.; Jakab, F.; Szabo, G. (Semmelweis Univ. Medical Sch., Mezo Imre ut 17, H-1430, Hungary). *Res. Exp. Med.* 171(3):263-270; 1977.

The effect of increased inferior vena cava pressure (IVCP) on hepatic circulation was studied in dogs. IVCP was raised by a balloon catheter introduced via the jugular vein. Hepatic artery flow (HAF) and portal venous flow (PVF) were measured with the electromagnetic flow meter. The increase of IVCP uniformly reduced HAF and PVF; the relative contribution of the two vessels to the HBF did not change. The relationship between IVCP increase and HAF reduction and between the decrease of hepatic artery (AP) IVCP and the reduction of HAF was linear. There was no sign of autoregulation or vasomotor regulation of HAF. The changes in IVCP were only

partially transmitted to the portal venous pressure (PVP). There was no change in intrahepatic portal resistance with increased IVCP. The increase in PVP did not lead to resistance changes in the splanchnic circulation. As a sign of the autoregulation of splanchnic circulation, the AP-PVP-versus-PVF curve was concave to the pressure axis. As a result of opposing autoregulatory and vasomotor influences in the intact animal, the hepatic circulation appears to react passively to the increased outflow pressure.

3646 COMPARISON OF THE METABOLISM OF CHYLOMICRONS AND CHYLOMICRON REMNANTS BY THE PERFUSED LIVER. (Eng.) Gardner, R. S.; Mayes, P. A. (Royal Veterinary Coll., London NW1 OTU, England). *Biochem. J.* 170(1):47-55; 1978.

The hepatic metabolism of chylomicrons and chylomicron remnants was compared after adding approximately equal numbers of each lipoprotein particle to the perfusate of isolated rat livers. At least 40% of the added remnants were metabolized by the liver, compared with less than 3% for chylomicrons. There was significantly more net removal of labeled remnants than of chylomicrons by the liver ($p<0.001$). A greater proportion of labeled cholesterol than of labeled triacylglycerol fatty acids was transferred to the liver from each lipoprotein. Cholesteryl esters of remnants were hydrolyzed, and triacylglycerol fatty acids of remnants were oxidized to CO_2 more extensively than those of chylomicrons. There was greater oxidation of remnant glycerolipid [1-^{14}C]oleate than of glycerolipid [1-^{14}C]palmitate. A large fraction of the fatty acids of remnants, but not of chylomicrons, was transferred to phospholipids, which were released by the liver in a lipoprotein of relative density less than 1.006. Label from remnants, but not from chylomicrons, was found in lipoproteins of relative density of over 1.006, which were not released during perfusion but could be flushed out from the liver at the end of perfusion. There are significant qualitative and quantitative differences in the metabolism of chylomicrons and chylomicron remnants.

3647 BILIARY EXCRETION OF SOME ANIONIC DERIVATIVES OF DIETHYLSTILBOESTROL AND PHENOLPHTHALEIN IN THE GUINEA PIG. (Eng.) Barford, P. A.; Olavesen, A. H.; Curtis, C. G.; Powell, G. M. (Dept. Biochemistry, Univ. Coll., P.O. Box 78, Cardiff CF1 1XL, Wales). *Biochem. J.* 168(3):373-377; 1977.

The metabolic fates and modes of excretion of diethylstilbestrol mono[^{35}S]sulfate and diethylstilbestrol di[^{35}S]sulfate were studied in guinea pigs. Comparative studies were also made with [G-^{3}H]diethylstilbestrol and phenolphthalein di[^{35}S]-sulfate. Diethylstilbestrol di[^{35}S]sulfate (1 mg/0.2 ml water/200 g) was extensively eliminated in the bile unchanged. After the administration of diethylstilbestrol mono[^{35}S]sulfate, extensive biliary elimination of radioactivity was also recorded. Radioactive components were identified as diethylstilbestrol disulfate, diethylstilbestrol monosulfate monoglucuronide, and unchanged diethylstilbestrol monosulfate. When [G-^{3}H]diethylstilbestrol was administered, ^{3}H-labeled diethylstilbestrol monoglucuronide, diethylstilbestrol monosulfate monoglucuronide, and diethylstilbestrol disulfate appeared in the bile. Phenolphthalein di[^{35}S]sulfate was excreted unchanged in bile. These findings are discussed in relation to studies carried out in the rat, and species differences are related to differences in enzyme activities in rat and guinea-pig liver.

3648 ORNITHINE DECARBOXYLASE ACTIVITY AND THE ONSET OF DEOXYRIBONUCLEIC ACID SYNTHESIS IN REGENERATING LIVER. (Eng.) McGowan, J. A.; Fausto, N. (Div. Biology, Brown Univ., Providence, RI 02912). *Biochem. J.* 170(1):123-127; 1978.

Ornithine decarboxylase activity and polyamine concentrations were measured in regenerating livers of protein-deprived and hypophysectomized male Holtzman rats. Compared with normally fed animals, rats fed on a low-protein diet for 3 days exhibited a considerable delay in DNA synthesis after partial hepatectomy. In the regenerating livers of these animals, the timing of the first peak of ornithine decarboxylase activity was not altered. The second peak of enzyme activity was delayed by a few hours, but polyamine concentrations were similar to those of normally fed rats. The results suggest that, regardless of the possible effect of polyamines on DNA synthesis, the time course of ornithine decarboxylase activity appears to be independent of the onset of DNA replication in regenerating livers.

3649 FATTY ACID SYNTHESIS IN THE REGENERATING LIVER OF THE RAT. (Eng.) Gove, C. D.; Hems, D. A. (St. George's Hosp. Medical Sch., Cranmer Terrace, London SW17 ORE, England). *Biochem. J.* 170(1):1-8; 1978.

Synthesis *de novo* of fatty acids in the rat liver was measured during regeneration by determining ^{3}H incorporation from $^{3}H_2O$ into fatty acids. Fatty acid synthesis, measured per gram of wet weight of tissue, was increased by a factor of about 2 between 1 and 4 days after partial hepatectomy, compared with rates in sham-operated control rat livers. There were no associated changes in the rates of liver cholesterol synthesis or of fatty acid synthesis in adipose tissue in rats after partial hepatectomy, compared with rates in sham-operated rats. In regenerating livers, perfused under three different conditions, there was no alteration in the capacity for fatty acid synthesis compared with that of control rats. The increased synthesis of fatty acids in regenerating liver was associated with insignificant increases in plasma concentrations of triacylglycerols and free fatty acids, with a decrease in content of liver glycogen, and with no change in hepatic activity of acetyl-coenzyme A carboxylase. The accelerated rate of fatty acid synthesis in regenerating liver appears not to be due to any intrinsic alteration in hepatic

capacity for fatty acid synthesis, but it may be caused by the continuous action on liver of unidentified circulating factors.

3650 PHOSPHOLIPIDS IN ENDOPLASMIC RETICULUM--THEIR RELATIONSHIP TO DRUG METABOLISM IN EXPERIMENTAL LIVER DISEASE. (Eng.) Gallenkamp, H. (Medizinische Universitatsklinik, Josef-Schneider-Str. 2, D-8700 Wurzburg, W. Germany). *Acta Hepatogastroenterol. (Stuttg.)* 24(5):309-316; 1977.

The effect of depletion or accumulation of phospholipids on membrane activity is reviewed, relying upon studies of choline deficiency in rats fed a choline-deficient diet (CDD) as an experimental model. Short-term choline deficiency tended to produce fatty liver and caused a remarkable decrease in phospholipid content in plasma and brain, while the alterations in liver microsomes were less pronounced. Within 24 hr, changes occurred in the floating lipid fraction of the liver homogenate; later, a general reduction of phospholipids, especially phosphatidylcholine, and a slight decrease in phosphatidylethanolamine. The protein content was largely unchanged in the first 5 days, but after 8 and 15 days, there were significant reductions in the microsomal protein content, and the cytochrome P450 content was slightly depressed. During acute (3-week) choline deficiency, the activity of several microsomal drug metabolizing enzymes (e.g., coumarin hydroxylase, hexobarbital oxidase, aminopyrine and ethylmorphine demethylase) decreased. Prolonged choline deficiency (up to 140 days) resulted in a fall of the plasma and brain phospholipid content, while the total microsomal phospholipid content in the liver was unchanged, and drug metabolizing activity was found to be normal both *in vivo* and *in vitro*. It is hypothesized that drug metabolizing activity in isolated microsomes or *in vivo* may depend on a balance of endoplasmic constituents and thus on a normal total phospholipid content and normal distribution of the phospholipid fraction and fatty acids and that imbalances lead to liver disease states. Under conditions of α-naphthyisocyanate-induced cholestasis, UDP-glucuronyl transferase activity was elevated, cytochrome P450 content was lowered, and microsomal protein content was elevated. In galactosamine-induced hepatitis, there was a decrease in cytochrome P450 content, a 2.5-fold increase in phospholipids, a ninefold increase in neutral lipids, and an elevation in the microsomal UDP-glucuronyl transferase activity. The elevation of the latter enzyme in both models of hepatocellular damage can be tentatively explained by an alteration in membrane structure. The role of phospholipids in human liver disease lacks firm proof because there is no information available about content and composition of phospholipids in human liver, so therapeutic use of essential phospholipids is controversial. There seems to be no established correlation between phospholipid content in liver disease and *in vivo* activity of drug-metabolizing enzymes.

3651 CHANGES IN RAT SERUM LIPOPROTEINS FOLLOWING LIGATION OF THE BILE DUCT. (Eng.) Hinton, R. H.; Mullock, B. M. (Wolfson Bioanalytical Center, Univ. Surrey, Guildford, Surrey GU2 5XH, England). *Clin. Chim. Acta* 82(1/2):31-44; 1978.

The serum lipoproteins of normal and of cholestatic rats were studied by crossed immunoelectrophoresis coupled with separations by rate and isopycnic density gradient centrifugation and by gel exclusion chromatography. Normal rat serum contained distinct lipoprotein species closely analogous to human very low density lipoprotein, low density lipoprotein, low density component of high density lipoprotein, and high density component of high density lipoprotein (VLDL, LDL, HDL_2, and HDL_3, resp.). Three days after common bile duct ligation, there were major changes in the lipoproteins of rat serum. The amounts of VLDL, LDL, and of a minor HDL component were elevated, and several novel types of lipoprotein were detected. Three of these were identified as the characteristic lipoprotein of cholestasis, lipoprotein x, as an enlarged and modified HDL, and as a lipoprotein of density 1.055 g/ml intermediate in size between LDL and VLDL. Some unusually small VLDL particles were also detected. It is concluded that the changes in rat serum lipoproteins following common bile duct ligation are very similar to the changes observed in cholestatic disease in human patients.

3652 MECHANISM OF SECRETION OF BILIARY LIPIDS: ROLE OF A MICROTUBULAR SYSTEM IN HEPATOCELLULAR TRANSPORT OF BILIARY LIPIDS IN THE RAT. (Eng.) Gregory, D. H.; Vlahcevic, Z. R.; Prugh, N. F.; Swell, L. (Veterans Admin. Hosp., Richmond, VA 23249). *Gastroenterology* 74(1):93-100; 1978.

The role of microtubules in the hepatocellular transport of biliary lipids was investigated, using the actively secreting isolated rat liver perfusion model and the microtubular blocking agents, vinblastine and colchicine. The liver was perfused with sodium taurocholate (12 μmol/hr) to produce active lipid secretion for 90 min before vinblastine administration and for 60 min before colchicine. The vinblastine- and colchicine-treated livers were then perfused for an additional 60 and 120 min, resp. Control groups received isotonic saline. Specific and nonspecific hepatic metabolic functions, including perfusion flow rates, protein and lecithin synthesis, bile acid uptake, and cytidine diphosphate choline 1,2-diglyceride transferase activity were not significantly altered by vinblastine (1×10^{-5} M or 5×10^{-5} M). Similarly, colchicine administration (5×10^{-6} M) had no effect on flow rates, protein synthesis, biliary lecithin metabolism, oxygen consumption, and β-hydroxybutyrate perfusate concentrations; colchicine did depress perfusate acetoacetate concentration by 33%. These viability criteria validate the metabolic integrity of this model for studying biliary lipid transport. Biliary lipid secretion and bile flow were significantly inhibited by both blocking agents at all concentrations. The selective effect on phospholipid and cholesterol output, however, was greater than for either bile acids or flow. These data support the concept that biliary lipids are secreted by a heterogeneous and complex

transport process and also provide definitive evidence that the hepatocyte microtubular network participates in the translocation of lipids from microsomes to the canalicular membrane.

3653 HEPATIC METABOLISM OF MEDIUM CHAIN TRIGLYCERIDES. (Eng.) Bach, A.; Debry, G.; Metais, P. (Hopital Civil, Strasbourg, France). *Bibl. Nutr. Dieta* (25):24-35; 1977.

The hepatic metabolism of medium-chain triglycerides (glycerol esters whose fatty acids contain between 6 and 12 carbon atoms) is reviewed. Medium-chain triglycerides are only slightly integrated into the hepatic lipids (octanoic acid is 6-18 times less incorporated into hepatic lipids by rat liver slices than is palmitic acid) and are mostly oxidized. This oxidation strongly activates ketogenesis and leads to a considerable rise in the redox potential in hepatocytes. After their ingestion, medium-chain triglycerides are hydrolyzed completely into fatty acids and their intestinal absorption is more complete and more rapid than that of long-chain triglycerides. Also, medium-chain triglycerides rely much less on the intestinal concentration of bile and pancreatic lipase than do long-chain triglycerides. The present utilization of medium-chain triglycerides principally concerns malabsorption syndromes, irrespective of whether the cause is surgical or medical or whether the origin is digestive, biliary, or pancreatic. The use of medium-chain triglycerides is contraindicated in all states of acidosis.

3654 BILE COMPOSITION IN RELATION TO RACE AND DIET: STUDIES IN RHODESIAN AFRICANS AND BRITISH SUBJECTS. (Eng.) Heaton, K. W.; Wicks, A. C. B.; Yeates, J. *In: Bile Acid Metabolism in Health and Disease. Proceedings of the IV Bile Acid Meeting held at the Hilton Hotel, Basel, Switzerland, October 11-12, 1976.* (University Park Press: Baltimore, MD): 197-202; 1977.

Differences in the composition of gallbladder bile were investigated in age- and sex-matched groups of urban Britons and urban and rural Africans, and an attempt was made to relate these differences to diet and nutritional status so that an explanation of the differing gallstone prevalence among these groups might be advanced and a clue to the etiology of gallstones obtained. Comparisons were made among three groups of men and between two groups of women: 12 British urban youths, 12 African urban youths, and 11 African rural youths on one hand and 12 British urban women and 10 African rural women on the other. The data collected consisted of their height and weight, an assessment by dietary recall of sucrose intake (in Africans only), and analysis of fasting plasma and duodenal bile. The total concentration of biliary lipids was usually greater in the African youths, averaging twice as high as in the British youths, suggesting that bile is more concentrated in African gallbladders. Pronounced differences were also found in the relative proportions of bile acids, phospholipids, and cholesterol in the bile of Britons and Africans, the values being 72 versus 82%, 24 versus 15.5%, and 4 versus 2.5%, resp. There was no significant difference among the male groups with respect to the relative proportions of cholate and chenodeoxycholate. However, deoxycholate was significantly more abundant in the bile of urban Britons than in that of rural Africans ($p<0.05$) or in that of Africans combined ($p<0.02$), due, perhaps, to the high cereal fiber intake of the African subjects (Rhodesians). In the women, the proportions of cholate, chenodeoxycholate, and deoxycholate were indistinguishable between African and British subjects. But as in the youths, the bile acids were significantly higher ($p<0.01$) and the phospholipid and cholesterol levels significantly lower ($p<0.02$ and $p<0.02$, resp.) in the African women. In both the male and female study groups, the cholesterol saturation index of the bile was not useful in distinguishing the groups. The glycine:taurine conjugation ratio in all the African youths or in the rural African youths alone was significantly higher than in the British youths ($p<0.05$ and $p<0.01$) and significantly higher in the African women than in the British women ($p<0.002$). These differences may also be due to the high fiber content of the Rhodesian diet. No significant relationship was found between the cholesterol saturation of bile and either body fatness (judged by weight relative to height), estimated sucrose intake, relative amount of chenodeoxycholate in bile, or percentage deoxycholate in bile.

3655 DISTRIBUTION OF BILE ACIDS IN RATS. (Eng.) Uchida, K.; Okuno, I.; Takase, H.; Nomura, Y.; Kadowaki, M.; Takeuchi, N. (Shionogi Res. Lab., Fukushima-ku, Osaka 553, Japan). *Lipids* 13(1):42-48; 1978.

The distribution and biliary and fecal excretion of bile acids were examined in male Wistar rats of about 300 g. The bile acid pool size of the rats on ordinary diet was 40 mg/rat, biliary secretion was 14 mg/hr, and fecal excretion was 10 mg/day. Bile acids were mainly located in the small and large intestinal contents (87% and 10%, resp., of the pool), but a portion was found in the intestinal wall and the liver. Rats fed 2% cholesterol-supplemented diet for 1 week showed similar values for pool size and biliary secretion with the rats on ordinary diet, but higher values for fecal excretion and distribution ratio in the large intestinal contents. Cholic acid was a major component in the bile, small intestinal wall, small intestinal content and liver, while the bile acid composition ratios were similar to each other, although a relatively large amount of α-muricholic acid was found in the intestinal wall and liver. Both the wall and content compositions of the large intestine were similar to that of the feces, in which lithocholic, deoxycholic, α- and β-muricholic acids were the main components, although the ratios of α- and β-muricholic acids in the large intestinal wall were larger than those in the intestinal contents or feces. The high concentrations of these bile acids may indicate a difference of transport velocity across the cell membrane.

3656 THE EFFECT OF FEEDING ON THE BILE SALT-INDEPENDENT CANALICULAR SECRETION IN DOGS. (Eng.) Austin, G. L.; Johnson, S. M.; Shires, G. T., III; Jones, R. S. (Duke Univ. Medical Center, Durham, NC 27710). *Am. J. Surg.* 135(1):36-39; 1978.

The effect of feeding on canalicular secretion was investigated in conscious dogs. Three dogs were prepared by cholecystectomy, ligation of the lesser pancreatic duct, and insertion of cannulas into the duodenum and stomach. Bile was collected by cannulating the common bile duct through the duodenal cannula. Canalicular secretion was estimated by the biliary clearance of erythritol. Feeding caused increased bile flow ($p<0.05$ at 3-4 hr), increased erythritol clearance ($p<0.05$ at 1 and 2 hr after feeding), decreased bile salt concentration ($p<0.05$ at 2 hr), and unchanged bile salt output. These findings indicate that feeding stimulated the bile salt-independent canalicular secretion.

3657 BILE ACID-INDUCED INCREASE IN BILE ACID-INDEPENDENT FLOW AND PLASMA MEMBRANE NaK-ATPase ACTIVITY IN RAT LIVER. (Eng.) Wannagat, F. J.; Adler, R. D.; Ockner, R. K. (Reginharstr. 30, D-506 Bensberg, W. Germany). *J. Clin. Invest.* 61 (2):297-307; 1978.

The mechanism for the significant increase in bile acid-independent secretion, expressed per mass of secreting parenchyma and seen in the livers of both selectively obstructed and bile acid-loaded rats, was investigated. Relative to controls, bile acid-independent flow per gram of nonobstructed liver was increased approximately threefold in selectively obstructed rats and 43% in bile acid-loaded rats with normal ducts. In rats infused with bile acids at similar rates for only 16 hr, no increase was observed. Studies with [^{14}C]erythritol suggest that the increased bile flow under these conditions was of canalicular origin. NaK-ATPase activity in canaliculi-enriched liver plasma membrane preparations from the nonobstructed lobes of selectively obstructed rats and from 48-hr bile acid-loaded rats was increased by 47% and 52%, resp., relative to controls, but was not increased in membranes from 16-hr bile acid-loaded rats. Canalicular membrane 5'-nucleotidase and Mg ATPase activities also were increased. These studies show that augmented bile acid flux through secreting liver causes an adaptive increase in bile acid-"independent" flow and in the activity of canalicular membrane enzymes. The mechanism by which bile acids modulate this and previously reported aspects of bile secretion remains to be elucidated.

3658 DEPENDENCE OF THE BILIARY EXCRETION OF IOPANOIC ACID ON BILE SALTS. (Eng.) Loeb, P. M.; Barnhart, J. L.; Berk, R. N. (Presbyterian Hosp., 8200 Walnut Hill Lane, Dallas, TX 75231). *Gastroenterology* 74(2, Part 1):174-181; 1978.

The extent to which iopanoate excretion in bile is dependent upon bile salt excretion was investigated in unanesthetized dogs with bile fistula. The biliary excretion of iopanoate was studied at four different rates of bile salt excretion in separate experiments produced by interruption of the enterohepatic circulation without bile salt infusion and by infusing sodium taurocholate at three constant rates (0.48, 1.87, and 3.21 μmol/min/kg). Iopanoic acid was infused in stepwise increasing rates in each of the four groups of experiments. The maximum excretion of iopanoate into bile (E_{max}) was derived from a computer fit of the relation between the biliary excretion rate and plasma concentration of iopanoate for each of the four rates of bile salt excretion. The calculated E_{max} was closely linked to the rate of bile salt excretion. The E_{max} increased in an apparent linear manner from 0.20 to 2.36 μmol/min/kg as the rate of bile salt excretion increased from 0.21 to 2.62 μmol/min/kg. From the slope of the relation between the biliary excretion of bile salts and the E_{max} of iopanoate, it was determined that 0.89 μmol of iopanoate was coupled with each μmol of bile salt. However, at low plasma concentrations of iopanoate (<0.06 μmol/ml), when maximum transport of the compound was not obtained, increasing rates of taurocholate infusion did not affect the biliary excretion of iopanoate. If these data in dogs can be extrapolated to man, the enhancement of the biliary excretion of iopanoate by bile salts indicates the importance of maintaining the enterohepatic circulation of bile salts during the biliary excretion phase of cholecystography with iopanoic acid.

3659 ERYTHRITOL AND MANNITOL CLEARANCES WITH TAUROCHOLATE AND SECRETIN-INDUCED CHOLERESES. (Eng.) Barnhart, J. L.; Combes, B. (Univ. Texas Southwestern Medical Sch., Dallas, TX 75235). *Am. J. Physiol.* 234(2):E146-E156; 1978.

To determine whether erythritol and mannitol enter bile during secretin-induced choleresis, the biliary clearances of ^{14}C-erythritol (C_{ery}) and ^{3}H-mannitol (C_{mann}) were measured simultaneously in dogs during choleresis induced by sodium taurocholate and by secretin. C_{ery} increased equally with the increase in bile flow induced by taurocholate, whereas mannitol entry into bile was partially restricted; the change in $(\Delta)C_{ery}/\Delta$bile flow averaged 0.96; $\Delta C_{mann}/\Delta C_{ery}$ averaged 0.81. Values for erythritol clearance exceeded bile flow by a constant volume over a wide range of bile flow readings, which suggests distal reabsorption of a fixed amount of fluid, independent of canalicular bile production. During secretin-induced choleresis, both C_{ery} and C_{mann} accompanied 30-40% of the increase in bile flow, and the C_{mann}/C_{ery} ratio was 1.02. Thus, the secretin-responsive region is permeable to both erythritol and mannitol. This fact affects the extent to which measured erythritol clearance accurately reflects canalicular bile formation; C_{ery} may underestimate or overestimate canalicular bile flow. The electrolyte composition of bile remained relatively constant over a broad range of bile flow samplings although the characteristics of taurocholate- and secretin-induced biles differed from each other.

Taurocholate-stimulated bile was virtually isotonic. Secretin-induced bile had a high total concentration of electrolyte (mean concentration 367 mEq/l) rich in chloride and bicarbonate and was hypertonic.

3660 EFFECT OF BILIARY OBSTRUCTION ON 26-HYDROXYLATION OF C_{27}-STEROIDS IN BILE ACID SYNTHESIS. (Eng.) Gustafsson, J. (Karolinska Institutet, Stockholm, Sweden). *J. Lipid Res.* 19 (2):237-243; 1978.

The effect of biliary obstruction on side chain hydroxylations in the biosynthesis and metabolism of bile acids was studied in male Sprague-Dawley rats. For comparison, several other hydroxylation reactions in bile acid biosynthesis and metabolism were assayed. Biliary obstruction inhibited microsomal 26-hydroxylation of 5β-cholestane-3α,7α-diol and microsomal 25- and 26-hydroxylation of 5β-cholestane-3α,7α,12α-triol. Microsomal 7α-hydroxylation of cholesterol and 6β-hydroxylation of lithocholic acid increased markedly, whereas the increase in microsomal 12α-hydroxylation of 5β-cholestane-3α,7α-diol was less. Mitochondrial 26-hydroxylation of cholesterol, 5-cholestene-3β,7α-diol, and 7α-hydroxy-4-cholesten-3-one was stimulated, whereas 26-hydroxylation of 5β-cholestane-3α,7α-diol was not affected and that of 5β-cholestane-3α,7α,12α-triol was markedly inhibited. The results indicate that mitochondrial 26-hydroxylation, particularly of substrates that are primarily precursors of chenodeoxycholic acid, plays a more important role in bile acid biosynthesis under conditions of biliary obstruction than under normal conditions.

3661 OCCURRENCE OF SULFATED 5α-CHOLANOATES IN RAT BILE. (Eng.) Eriksson, H.; Taylor, W.; Sjovall, J. (Karolinska Inst., Stockholm, Sweden). *J. Lipid Res.* 19(2):177-186; 1978.

Bile acids in bile from male and female Sprague-Dawley rats with cannulated bile ducts were analyzed by repetitive scanning gas-liquid chromatography-mass spectrometry after initial fractionation of conjugate classes on diethylaminohydroxypropyl Sephadex LH-20. The proportion of total bile acids excreted as sulfates was higher in female (0.9-1.3%) than in male (0.1-0.2%) rats. Most of the sulfated bile acids had a 5α-configuration, allochenodeoxycholic acid being the major compound in bile from female rats. This bile acid was also present in the nonsulfate fraction but could not be found in bile from male rats. The results indicate that gas-liquid chromatography-mass spectrometry must be used to provide sufficient specificity in bile acid analyses. Thus, compounds from the sulfate fraction having the retention times of cholic and chenodeoxycholic acid derivatives are found to be due to derivatives of the 3β,5α-isomers of these bile acids.

3662 SUITABILITY OF [11,12-$^3H_2$]CHENODEOXYCHOLIC ACID AND [11,12-$^3H_2$]LITHOCHOLIC ACID FOR ISOTOPE DILUTION STUDIES OF BILE ACID METABOLISM IN MAN. (Eng.) Ng, P. Y.; Allan, R. N.; Hofmann, A. F. (Mayo Foundation and Medical Sch., Rochester, MN 55901). *J. Lipid Res.* 18(6):753-758; 1977.

The stability of the label in [11,12-$^3H_2$]chenodeoxycholic acid and [11,12-$^3H_2$]lithocholic acid during enterohepatic cycling was assessed to define the suitability of these tracers for isotope dilution studies of bile acids in man. [11,12-$^3H_2$]chenodeoxycholic acid (60 μCi) and [24-^{14}C]chenodeoxycholic acid (20 μCi) were administered simultaneously to six healthy adults. The $^3H/^{14}C$ ratio of biliary chenodeoxycholic acid and the specific activity of biliary chenodeoxycholic acid were determined to permit calculation of pool size and turnover rate. Urinary label excretion was measured as well as the $^3H/^{14}C$ ratio of fecal bile acids. Similar studies were carried out with [11,12-$^3H_2$]lithocholic acid and [24-^{14}C]lithocholic acid. With [11,12-$^3H_2$]chenodeoxycholic acid, 10-15% of the label was lost during the first 24 hr, after which the $^3H/^{14}C$ ratio of biliary chenodeoxycholic acid remained constant. The loss of ^3H caused a consistent overestimate of pool size by 10-15%, but since the fractional turnover rate of the two isotopes was identical, the calculated rate of synthesis was 10-15% greater when determined using ^3H. The loss of ^3H was attributed to the presence of ^3H in positions other than 11 and 12 occurring during the labeling procedure when the unsaturated precursor was exposed to carrier-free tritium gas. The $^3H/^{14}C$ ratio of feces was consistently below that of bile, suggesting bacterial removal of additional ^3H during distal intestinal passage. In contrast, [11,12-$^3H_2$]-lithocholic acid lost ^3H continuously, so that by 2 days after administration, the $^3H/^{14}C$ ratio had fallen to nearly half of that of the administered mixture. It is concluded that isotope dilution studies may be carried out with one preparation of [11,12-$^3H_2$]chenodeoxycholic acid with an error of 10-15%; possibly a more stable preparation can be made with a gentler tritiation procedure. One preparation of [11,12-$^3H_2$]lithocholic acid was unsatisfactory for isotope dilution studies in man.

3663 COMPARATIVE EFFECTS OF URSODEOXYCHOLIC ACID AND CHENODEOXYCHOLIC ACID IN THE RHESUS MONKEY: BIOCHEMICAL AND ULTRASTRUCTURAL STUDIES. (Eng.) Fedorowski, T.; Salen, G.; Zaki, F. G.; Shefer, S.; Mosbach, E. H. (Veterans Admin. Hosp., East Orange, NJ 07019). *Gastroenterology* 74(1):75-80; 1978.

To investigate the effects of bile acid feeding on hepatic function, rhesus monkeys were treated with 40 and 100 mg/kg/day of ursodeoxycholic acid (UDCA, 3α,7β-dihydroxycholanoic acid) and chenodeoxycholic acid (CDCA, 3α,7α-dihydroxycholanoic acid), resp. Serum liver enzyme levels were measured at the start of the studies, at monthly intervals thereafter, and terminally. After 6 months, all animals were killed, and the hepatic morphology was examined by light and electron microscopy; biliary bile acid composition and fecal bile composition were determined by gas-liquid chromatography. Liver damage developed

in the CDCA-treated animals and consisted of bile duct proliferation, periportal inflammation, fibrosis, and disruption of bile canaliculi, and was associated with a 4- to 10-fold rise in serum transaminase and leucine aminopeptidase levels. Biliary lithocholic acid rose to 10% of the total biliary bile acids in the CDCA-treated animals. In contrast, liver morphology and liver function tests (SGOT, SGPT, and leucine aminopeptidase) were not affected by either 40 or 100 mg/kg/day of UDCA; biliary lithocholic acid concentrations did not change appreciably. Hepatic β-hydroxy-β-methylglutaryl coenzyme A reductase activity (reflecting cholesterogenesis) was suppressed equally (30%) by UDCA and CDCA, but serum cholesterol levels did not change. These findings confirm that CDCA is associated with serious liver damage that probably results from increased formation of lithocholic acid. In contrast, UDCA caused no liver toxicity and no rise in lithocholic acid. Thus, the 7β-hydroxy group of UDCA was apparently degraded differently than the 7α-hydroxy group of CDCA, suggesting that intestinal bacterial dehydroxylases are stereospecific. Because of different bacterial degradation, gallstone treatment with UDCA may be safer and more economical.

3664 STIMULATION OF THYMIDINE INCORPORATION IN MOUSE LIVER AND BILIARY TRACT EPITHELIUM BY LITHOCHOLATE AND DEOXYCHOLATE. (Eng.) Bagheri, S. A.; Bolt, M. G.; Boyer, J. L.; Palmer, R. H. (Franklin McLean Memorial Res. Inst., Univ. Chicago, Chicago, IL). *Gastroenterology* 74(2, Part 1):188-192; 1978.

The early effects of lithocholate and related bile salts on the liver and biliary tract were investigated in female mice by measuring tritiated thymidine (^{3}HTdR) incorporation into DNA after single p.o. doses of bile salts. Lithocholate (≥12.5 mg) enhanced incorporation of ^{3}HTdR at 28 and 36 hr in gallbladder epithelium and at 36 hr in hepatocytes. Areas of hepatocellular necrosis, resembling the lesions of peliosis hepatis, occurred with 12.5- and 25-mg doses of lithocholate, but were not seen with deoxycholate, cholate, chenodeoxycholate, ursodeoxycholate, or hyodeoxycholate. Deoxycholate, and to a lesser extent cholate, also stimulated ^{3}HTdR incorporation in both liver and gallbladder, but chenodeoxycholate did not. These studies suggest that certain bile acids rapidly exert major effects on cell kinetics in the liver and biliary tract, and that these effects depend on the structure of the bile acid molecule. Bile duct (organ) hyperplasia induced by lithocholate must depend on additional factors. The stimulation of proliferative activity by certain (particularly secondary) bile acids may have important consequences for tissues and organs exposed to the bile acid pool during its enterohepatic circulation and subsequent excretion via the colon.

3665 METABOLISM OF URSODEOXYCHOLIC ACID IN MAN. (Eng.) Fedorowski, T.; Salen, G.; Colalillo, A.; Tint, G. S.; Mosbach, E. H.; Hall, J. C. (Veterans Admin. Hosp., East Orange, NJ 07019). *Gastroenterology* 73(5):1131-1137; 1977.

Ursodeoxycholic acid metabolism was investigated in seven subjects during treatment with ursodeoxycholic acid (1 g/day) and chenodeoxycholic acid (1 g/day) for 2 weeks. The molar proportions of biliary cholesterol, lecithin, and bile salts were determined before and during bile acid treatment, and the pool sizes and daily turnover of ursodeoxycholic acid were measured by isotope dilution techniques after the administration of [24-^{14}C]ursodeoxycholic acid. Ursodeoxycholic acid became the major biliary bile acid (56%) during ursodeoxycholic acid treatment, while the proportion of chenodeoxycholic acid declined from 32% to 18% and of cholic acid from 38% to 17%. Deoxycholic acid and lithocholic acid were virtually absent from the bile. During chenodeoxycholic acid administration, chenodeoxycholic acid became the major biliary bile acid (59%), cholic acid declined to 22% of the biliary bile acids, and the proportion of lithocholic acid rose from 1.3% to 3.4%, and an additional 4% were sulfated. Ursodeoxycholic acid increased to 8% of the total bile acids. The molar percentage of biliary cholesterol decreased from 8% to 5% during both ursodeoxycholic acid and chenodeoxycholic acid administration. After [24-^{14}C]ursodeoxycholic acid was administered i.v., the biliary specific activity time curves of ursodeoxycholic acid decayed exponentially during both bile acid treatment periods. In the ursodeoxycholic acid-treated subjects, the ursodeoxycholic acid decay curve intersected with the rising specific activity curve of chenodeoxycholic acid and revealed a precursor-product relationship. The average ursodeoxycholic acid pool measured 938 ± 458 mg with a daily production rate of 900 ± 438 mg/day (absorption). The average ursodeoxycholic acid pool during chenodeoxycholic acid treatment measured 123 ± 82 mg, and the production rate was 91 ± 35 mg/day (synthesis). These studies demonstrate that substantial quantities of ursodeoxycholic acid are absorbed when this bile acid is fed or are synthesized when chenodeoxycholic acid is given. The reduction in bile lithogenicity during ursodeoxycholic acid administration implies that this bile acid, like chenodeoxycholic acid, may be effective in dissolving cholesterol gallstones in man.

3666 HEPATIC ACCUMULATION AND INTRACELLULAR BINDING OF CONJUGATED BILIRUBIN. (Eng.) Wolkoff, A. W.; Ketley, J. N.; Waggoner, J. G.; Berk, P. D.; Jakoby, W. B. (Albert Einstein Coll. Medicine, Bronx, NY). *J. Clin. Invest.* 61(1):142-149; 1978.

Hepatic accumulation and intracellular binding of conjugated bilirubin were studied in Sprague-Dawley and Wistar R rats. After the i.v. injection of unconjugated ^{3}H-bilirubin into normal rats, radiolabeled bile pigments rapidly accumulated in the liver. By 1.5 min after injection, an average of 36% of the injected isotope was present in liver homogenates. Between 3 and 15 min, 37-64% of the total intrahepatic radiolabeled bilirubin was conjugated, as demonstrated by extraction of label

into the polar phase of a solvent partition system. This indicates both rapid conjugation and accumulation of conjugated bilirubin within the liver cell. Fluorometric determination of the dissociation constants of purified bilirubin and its mono- and di-glucuronides for homogeneous preparations of two human and four rat glutathione S-transferases, including ligandin, revealed avid binding of all three bile pigments to this class of proteins. Hence, the observation that the intrahepatic bile pigment pool contains substantial amounts of conjugated bilirubin can be attributed to the high binding affinities observed. Thin-layer chromatographic analysis of the ^{3}H-pigments produced by *p*-iodoaniline diazotization of homogenates and cytosol demonstrated that the intrahepatic pool of conjugated bilirubin was almost exclusively monoglucuronide. Examination of radiolabeled bilirubin conjugates excreted in bile during the first 20 min after injection of ^{3}H-bilirubin showed no preferential excretion of diglucuronide. These studies indicate that both bilirubin and its monoglucuronide accumulate within the liver cell as ligands with the glutathione S-transferase and that bilirubin diglucuronide does not significantly accumulate within the general intrahepatocellular pool of protein-bound bile pigments. The latter observation is compatible with the formation and excretion of bilirubin diglucuronide directly from the canalicular pool of the liver cell.

3667 CHOLESTEROL GALLSTONES AND BILIARY LIPID METABOLISM IN THE PRIMATE. (Eng.) Redinger, R. N.; Grace, D. M. (Univ. Hosp., Univ. Western Ontario, London, Ontario N6A 5A5, Canada). *Gastroenterology* 74(2, Part 1):201-204; 1978.

A primate model for the study of cholesterol gallstones is described. Bile became supersaturated with cholesterol in seven female adult baboons with exteriorized enterohepatic circulations during cholestyramine treatment (0.2 g/kg/day, intraduodenally). Cholestyramine decreased bile acid pool size (1.38 ± 0.7 to 0.45 ± 0.02 mmol, $p<0.001$) and secretion rate (12.7 ± 0.9 to 5.6 ± 0.5 mmol/24 hr), while cholesterol secretion remained unaltered. Although biliary lipid and bile acid composition were similarly affected by treatment in both cholecystectomized and intact animals, cholesterol stones formed only in the latter. Thus metabolic alterations in biliary lipid metabolism as well as the presence of the gallbladder were necessary for stone formation.

3668 EVIDENCE FOR A COMMON HEPATIC CHOLESTEROL PRECURSOR SITE FOR CHOLIC AND CHENODEOXYCHOLIC ACID SYNTHESIS IN MAN. (Eng.) Schwartz, C. C.; Vlahcevic, Z. R.; Halloran, L. G.; Nisman, R.; Swell, L. (Veterans Admin. Hosp., Richmond, VA 23249). *Proc. Soc. Exp. Biol. Med.* 156(2):261-264; 1977.

The question of whether cholic and chenodeoxycholic acids arise from a specific cholesterol precursor site in man was investigated in patients with bile fistulae. The patients received ^{14}C-cholesterol and labeled mevalonic acid by constant infusion (for 5 hr) or by i.v. pulse. Bile was collected at 20- to 60-min intervals for 4 hr following the administration of the labeled compounds, and then at longer intervals up to 24 hr. The specific activities of newly synthesized cholic and chenodeoxycholic acids were virtually identical at all time periods. These observations provide evidence for the presence of a common cholesterol substrate pool for primary bile acid synthesis in man. Both cholic and chenodeoxycholic acids appear to be synthesized via the 7α-hydroxycholesterol pathway.

3669 DYNAMICS OF CHOLESTEROL GALLSTONE DISSOLUTION IN CANINE BILE. (Eng.) Thurston, O. G. (Dept. Surgery, Univ. Alberta, Edmonton, Alberta, Canada). *J. Surg. Res.* 24(1):15-19; 1978.

Studies on the dynamics of cholesterol gallstone dissolution in canine bile were carried out using human gallstones. Two cholesterol gallstones, matched for size and gross morphology, were obtained from each of seven patients undergoing cholecystectomy. The cholesterol content of one stone was determined. The second stone was dried, weighed, and measured, and its surface area was calculated. The second stone was then implanted singly into a dog's gallbladder for 21-24 days. The rate of stone dissolution, the effects of stone size and cholesterol content on dissolution rate, and the effect of dissolution on biliary lipids were studied. The rate of stone dissolution varied from 6.9 to 37.9 μg/day/mm^2 and was dependent upon initial surface area of the stone and, to a lesser extent, on cholesterol content of the matched stone. The rate of dissolution declined with the largest stones, suggesting that bile displacement from the gallbladder was a factor. The molar percentage of cholesterol in gallbladder bile increased during the period of dissolution, indicating that gallstones themselves may influence biliary lipid composition.

3670 THE RELATIONSHIP OF CHOLECYSTECTOMY AND TAUROCHOLIC ACID FEEDING TO BILE COMPOSITION AND HEPATOCYTE FUNCTION IN PRAIRIE DOGS. (Eng.) Gardner, B.; Chenouda, M.; Dennis, C.; Patti, J. (Downstate Medical Center, State Univ. New York, 450 Clarkson Ave., Brooklyn, NY 11203). *Am. J. Surg.* 135(1):40-47; 1978.

The prairie dog was used as a model for human gallstone formation. Serum cholesterol was measured at intervals in animals on the lithogenic diet for a period up to 1 yr. Bile collections were made over 24 hr at 1-hr intervals up to 10 hr, and then the remaining 14-hr collection was pooled. Stones formed in the gallbladder of all animals on a lithogenic diet. Hepatic bile was nonlithogenic, whereas gallbladder bile promoted cholesterol precipitation. The addition of taurocholate (2 g/100 ml, 3-4 months) to the lithogenic diet reduced the number of stones and lithogenicity. Cholecystectomy re-

sulted in an increased bile flow and reduced secretion of cholesterol in the animals on a high cholesterol diet. Reduction of cholesterol and bile acid synthesis by negative feedback was demonstrated in isolated hepatocyte culture. The shift of bile salt production to chenodeoxycholates on a high cholesterol intake was demonstrated both *in vivo* and *in vitro*. A theory of gallstone formation is presented that hypothesizes a defect in hepatocyte storage of cholesterol rather than bile acid synthesis as the primary effect, relegating the problem to one of a disease of lipid metabolism.

3671 EFFECT OF AUTOCLAVING OF A LACTOSE-CONTAINING DIET ON CHOLESTEROL AND BILE ACID METABOLISM OF CONVENTIONAL AND GERM-FREE RATS. (Eng.) Wostmann, B. S.; Beaver, M.; Chang, L.; Madsen, D. (Dept. Microbiology, Univ. Notre Dame, Notre Dame, IN 46556). *Am. J. Clin. Nutr.* 30(2): 1999-2005; 1977.

Studies were carried out in conventional and germ-free male Lobund-Wistar rats to determine whether lactose fed at levels usually consumed by the adult population of developed countries could influence cholesterol and bile acid metabolism to a major extent. Feeding lactose in amounts comparable to the adult human intake (6% of diet, and in later studies 10%) had no major effect on the cholesterol and bile acid metabolism of germ-free and conventional rats. However, when lactose-containing casein-starch diets were sterilized by autoclaving, changes in intestinal and/or fecal bile acids were found. Both germ-free and conventional rats demonstrated some increase in intestinal β-muricholic acid concentrations ascribable to the mere presence of lactose in the diet. Autoclaving the diet produced additional changes, especially in the fecal bile acid pattern of conventional rats; the ratio between the β-muricholic-derived secondary bile acids hyodeoxycholic and ω-muricholic acids changed from the usual 5:3 to approximately 1:10, with ω-muricholic acid becoming the major fecal bile acid. These changes point to a notable effect of lactose-derived products, formed during steam sterilization, on the microbial modification of intestinal bile acids in the lower gut.

3672 THE EFFECT OF CALCIUM ON THE OXIDATION OF ACETALDEHYDE BY RAT LIVER MITOCHONDRIA. (Eng.) Cederbaum, A. I. (Mount Sinai Sch. Medicine of the City Univ. New York, New York, NY 10029). *Life Sci.* 22(1):111-125; 1978.

The influence of Ca^{2+} and the cationic environment on the oxidation of acetaldehyde by liver isolated rat mitochondria was studied. Oxidation of acetaldehyde proceeded at different rates under three different conditions: state 4<state 3<valinomycin. Ca^{2+} (>0.10 mM) inhibited the oxidation of acetaldehyde by the isolated mitochondria under all conditions. Valinomycin-stimulated oxidation of acetaldehyde was more sensitive to inhibition by Ca^{2+} than were the state 3 or 4 rates of acetaldehyde oxidation. Acetaldehyde could support an energy-dependent uptake of Ca^{2+} at rates about 20% of that found with succinate. Ruthenium red almost completely prevented the inhibition by Ca^{2+} under all conditions. The addition of externally added NAD^+ or NADH provided complete relief against the inhibitions by Ca^{2+} of the state 4 and 3 rates of acetaldehyde oxidation. Although some relief was also observed with the valinomycin-stimulated system, significant inhibition persisted. Cations such as Zn^{2+}, Cu^{2+}, or Hg^{2+} also inhibited acetaldehyde oxidation, whereas Mg^{2+} and Mn^{2+} were without effect. These cations also blocked glutamate oxidation, and presumably inhibit acetaldehyde oxidation by preventing reoxidation of NADH. The greater sensitivity of the ionophore-stimulated oxidation of acetaldehyde to inhibition by Ca^{2+} may reflect release of intramitochondrial K^+, which is known to occur in the presence of Ca^{2+}, suggesting that acetaldehyde oxidation is influenced by the cation environment within the mitochondria.

3673 EVIDENCE THAT ACETALDEHYDE IRREVERSIBLY IMPAIRS GLYCOPROTEIN METABOLISM IN LIVER SLICES. (Eng.) Sorrell, M. F.; Tuma, D. J.; Barak, A. J. (Veterans Admin. Hosp., 4101 Woolworth Ave., Omaha, NB 68105). *Gastroenterology* 73(5):1138-1141; 1977.

The reversibility of acetaldehyde inhibition of glycoprotein synthesis was investigated in Sprague-Dawley rat liver. When liver slices were incubated for 1 hr in a medium containing either 5 mM acetaldehyde or ethanol and then switched to a fresh medium free from acetaldehyde but containing the appropriate radioactive precursors and reincubated for an additional 3 hr, a decreased incorporation of both [^{14}C]glucosamine and [^{14}C]leucine into hepatocellular and secretory proteins was observed. Further studies were carried out comparing the inhibitory effects of ethanol and acetaldehyde on drug metabolism. Higher concentrations of ethanol were necessary to impair aniline hydroxylation when compared to its effect on glycoprotein metabolism. Acetaldehyde did not affect aniline metabolism, suggesting some specificity for its effect on intracellular metabolic functions. These results show that the acetaldehyde-induced inhibition of glycoprotein synthesis is irreversible under these short-term experimental conditions and is not dependent on the physical presence of acetaldehyde in the incubation medium.

3674 THE EFFECTS OF FRUCTOSE AND OTHER SUBSTANCES ON ACETALDEHYDE AND ETHANOL METABOLISM IN THE RAT. (Eng.) Rawat, A. K. (Medical Coll. Ohio, Toledo, OH 43699). *Res. Commun. Chem. Pathol. Pharmacol.* 18(4):665-676; 1977.

The comparative effectiveness of fructose, glucose, sucrose, and alanine in increasing the rates of ethanol and acetaldehyde clearance was tested in male rats. The administration of fructose i.v. was found to be the most effective, followed by alanine, in increasing the rate of blood alcohol clearance; clearance was increased from 55.7 ± 4 μmol/ml/hr

to 132.5 ± 14 μmol/ml/hr with fructose and to 120.0 ± 11 μmol/ml/hr with alanine. The administration of any one of the test substances during ethanol metabolism did not result in a significant change in the levels of blood acetaldehyde. Fructose partially prevented the ethanol-mediated changes in the concentration ratios of lactate/pyruvate and β-hydroxybutyrate/acetoacetate. Its administration also resulted in the reversal of acetaldehyde-mediated changes in the liver. The administration of all test substances resulted in an increase in hepatic glucose levels; however, a combination of these substances with ethanol resulted in decreased hepatic glucose levels. The most pronounced effect on glucose was observed when ethanol was given in combination with glucose. During the simultaneous metabolism of fructose and ethanol, hepatic and blood levels of sorbitol increased markedly. Fructose also exerted the most pronounced antiketogenic action. The increased rates of blood alcohol clearance induced by fructose and alanine are exerted at the hepatic level by producing a more oxidized state of the liver; these observations are of special interest in view of the recent trend toward employing fructose for the treatment of acute ethanol intoxication.

3675 COMMON MECHANISM FOR THE ADAPTIVE INCREASE IN HEPATIC ETHANOL AND ACETALDEHYDE METABOLISM DUE TO CHRONIC PRETREATMENT WITH ETHANOL. (Eng.) Thurman, R. G.; Brentzel, H. J.; McKenna, W. R. (Univ. Pennsylvania Sch. Medicine, Philadelphia, PA 19174). *Adv. Exp. Med. Biol.* 85A:237-245; 1977.

The effect of chronic ethanol pretreatment on acetaldehyde metabolism was investigated in the perfused rat liver, and evidence that supports the involvement of reoxidation of NADH in stimulating ethanol oxidation in ethanol-treated animals is reviewed. Livers from rats pretreated with ethanol for 3-5 weeks utilized ethanol and acetaldehyde at higher rates than did appropriate controls. This adaptive increase in hepatic ethanol and acetaldehyde uptake was associated with marked (>60%) increase in hepatic oxygen uptake. Ethanol uptake in both ethanol-treated and control livers was similarly sensitive to inhibition by 4-methylpyrazole, rotenone, and antimycin A. The adaptive increase in ethanol uptake was apparently specifically abolished by ouabain. These data are consistent with the hypothesis that chronic treatment with ethanol increases ATPase activity. The ADP produced from these initiating events enters the mitochondrial space and stimulates electron transport and oxygen uptake. As a consequence of these events, a greater rate of NADH reoxidation occurs, resulting in a greater rate of production of NAD^+, which stimulates ethanol oxidation via alcohol dehydrogenase and acetaldehyde oxidation via aldehyde dehydrogenase(s).

3676 ETHANOL OXIDATION BY ISOLATED HEPATOCYTES FROM ETHANOL-TREATED AND CONTROL RATS: FACTORS CONTRIBUTING TO THE METABOLIC ADAPTATION AFTER CHRONIC ETHANOL CONSUMPTION. (Eng.) Cederbaum, A. I.; Dicker, E.; Lieber, C. S.; Rubin, E. (Mount Sinai Sch. Medicine, City Univ. New York, New York, NY 10029). *Biochem. Pharmacol.* 27(1): 7-15; 1978.

Various aspects of ethanol oxidation were studied in hepatocytes isolated from rats chronically fed ethanol and from controls to investigate factors contributing to metabolic adaptation after chronic ethanol consumption. Chronic ethanol consumption (36% of total calories for 4 weeks) by rats produced a fatty liver and resulted in a pronounced increase in the rate of ethanol oxidation by isolated hepatocytes. Despite the increase in ethanol oxidation, oxygen consumption with several substrates was not enhanced after chronic ethanol treatment. Ouabain did not abolish the increase in the rate of ethanol oxidation. About 40-50% of the increase in ethanol oxidation persisted after inhibition of alcohol dehydrogenase, mitochondrial oxygen consumption, or the malate-aspartate shuttle. The addition of substrates for the malate-aspartate shuttle slightly increased the rate of ethanol oxidation in hepatocytes from control and ethanol-treated animals. The increased rate of ethanol oxidation was not abolished by the uncoupling agent dinitrophenol, which by itself had little effect on ethanol oxidation. In the presence of aspartate or α-glycerophosphate, dinitrophenol augmented the rate of ethanol oxidation; in the presence of glutamate, the rate of ethanol oxidation was doubled by dinitrophenol. However, the higher rate of ethanol oxidation after ethanol consumption was still found in the presence of various combinations of substrate shuttles, with or without dinitrophenol. Pathways independent of alcohol dehydrogenase may contribute, at least in part, to the increase in ethanol oxidation found after chronic ethanol consumption. It is concluded that ethanol oxidation may be enhanced after chronic ethanol consumption without the establishment of a hypermetabolic state of the liver.

3677 DIFFERENTIAL EFFECT OF ETHANOL INGESTION ON THE PROTEIN SYNTHETIC ACTIVITIES OF FREE AND MEMBRANE-BOUND RIBOSOMES FROM LIVER OF THE WEANLING RAT. (Eng.) Khawaja, J. A.; Lindholm, D. B. (Dept. Medical Chemistry, Univ. Helsinki, Siltavuorenpenger 10 A, SF-00170 Helsinki 17, Finland). *Res. Commun. Chem. Pathol. Pharmacol.* 19(1): 129-139; 1978.

The influence of chronic ethanol ingestion on the protein synthetic activities of free and membrane-bound ribosomes was studied *in vitro* in the liver of 25-day-old male Sprague-Dawley rats. Ethanol administration (6.3% volume/volume of diet for 13 days) caused about 120% increase in the incorporation of amino acids by free ribosomes. In contrast, membrane-bound ribosomes from the livers of ethanol-fed animals exhibited a 25% decline in their protein synthetic activity. This decline in the activity of membrane-bound ribosomes was abolished after dissolution of membranes by Triton X-100. The observed alterations in protein synthesis due

to ethanol intake may be the result of changes in the pH 5 enzyme fraction, an altered amount of ribosome-associated messenger RNA, and damage to the endoplasmic reticulum.

3678 KINETICS OF ETHANOL INHIBITION OF GALACTOSE ELIMINATION IN PERFUSED PIG LIVER. (Eng.) Keiding, S.; Johansen, S.; Tonnesen, K. (Rigshospitalet, DK-2100 Copenhagen, Denmark). *Scand. J. Clin. Lab. Invest.* 37(6):487-494; 1977.

The effect of ethanol (5-25 mM) on galactose elimination kinetics in the intact liver was studied in the isolated perfused pig liver, using the steady-state infusion technique. Ethanol reduced galactose V_{max} in six experiments to 0.07 mmol/min/kg liver (average) from 0.43 mmol/min/kg obtained in control experiments without ethanol. Also, K_m was significantly reduced from 0.23 mM plasma water to 0.03 mM. Ethanol increased uridine diphosphate (UDP)-galactose 10-fold simultaneous with a rise in the hepatic outflow ratio of lactate to pyruvate to about 300 from 10; this finding indicates that ethanol inhibits epimerase activity. In experiments with increasing galactose elimination rates, the galactose-1-P concentration increased much less than the concentration of galactose, and the phosphorylation of galactose therefore seems to be rate-limiting. *In vitro*, galactokinase activity is inhibited by galactose-1-P. In the present study, ethanol increased galactose-1-P 5-10 times, and the reduction of V_{max} and K_m by ethanol could be explained by uncompetitive inhibition by galactose-1-P with K_i about 0.1 mM. Ethanol decreased UDP-glucose to about 40% and uridine triphosphate to less than 5% probably due to trapping as UDP-galactose. This trapping may depress the forward transferase reaction, and therefore the other cosubstrate galactose-1-P rises and inhibits galactokinase activity.

3679 ETHANOL-INDUCED HYPOGLYCAEMIA IN MAN: ITS SUPPRESSION BY THE ALCOHOL DEHYDROGENASE INHIBITOR 4-METHYLPYRAZOLE. (Eng.) Salaspuro, M. P.; Pikkarainen, P.; Lindros, K. (Univ. Central Hosp. Helsinki, SF-00290 Helsinki 29, Finland). *Eur. J. Clin. Invest.* 7(6):487-490; 1977.

To examine whether alcohol hypoglycemia can be prevented by 4-methylpyrazole (4-MP) in humans and how this inhibition is related to changes in the redox state of the NAD/NADH couple, the redox state, which reflects the metabolites lactate, pyruvate, 3-hydroxybutyrate, and acetoacetate, was determined from venous blood in 10 healthy subjects. The rate of ethanol elimination and blood concentrations of acetaldehyde were also determined. The infusion of ethanol (0.6 g/kg) caused marked hypoglycemia in subjects fasted for 36 hr. Previous administration of the alcohol dehydrogenase (ADH) inhibitor 4-MP (7 mg/kg, i.v.) strongly suppressed the ethanol-induced hypoglycemia. The rate of ethanol elimination was 84.6 mg/kg/hr. 4-MP caused a 21% reduction of ethanol elimination but had no significant effect on blood acetaldehyde levels. 4-MP also significantly suppressed the ethanol-induced elevation of blood lactate and almost completely prevented the increase in the 3-hydroxybutyrate/acetoacetate ratio, but had only a slight effect on the lactate/pyruvate ratio of venous blood. The results demonstrate that the hypoglycemia and lactacidemia produced by alcohol oxidation can be prevented by a dose of 4-MP that diminishes or prevents the ethanol-induced shift in the NAD-coupled redox state of the liver.

3680 EFFECT OF AMP ON ACUTE CARBON-TETRACHLORIDE HEPATOTOXICITY. (Eng.) Mikhail, T. H.; Awadallah, R.; Dessoukey, E. A. (Natl. Res. Centre, Dokki, Cairo, Egypt). *Z. Ernaehrungswiss.* 16(4):256-261; 1977.

The protective effect of AMP on carbon tetrachloride (CCl_4) hepatotoxicity was studied in adult albino rats. Rats injected i.p. with 0.5 ml of a CCl_4-mineral oil mixture (1:1 by volume) per 100 g body weight showed significant ($p<0.05$) increases in SGOT (107.4 ± 12.9 versus 69.3 ± 13.0 IU/l for controls), SGPT (152.3 ± 17.7 versus 27.8 ± 7.9 IU/l for controls), alkaline phosphatase (38.9 ± 4.2 versus 16.8 ± 2.9 King-Armstrong U for controls), and total liver lipids (10.99 ± 1.42 versus 4.67 ± .82 g% for controls) and a significant ($p<0.05$) decrease in the albumin/total globulin ratio (0.46 ± .03 versus 0.73 ± .08 for controls). The i.p. administration of 30 mg/rat of AMP 30 min before CCl_4 treatment afforded protection against CCl_4 hepatotoxicity as judged by significantly ($p<0.05$) decreased levels of SGOT (91.2 ± 1.0 IU/l), SGPT (86.0 ± 16.9 IU/l), alkaline phosphatase (19.9 ± 5.7 King-Armstrong U), and total liver lipids (7.80 ± 0.73 g%) and a significantly ($p<0.05$) increased albumin/total globulin ratio (0.59 ± .08). The administration of AMP had no effect on serum total protein. Acute CCl_4 hepatotoxicity produces fatty liver associated with elevations in certain serum enzyme levels and a decrease in the albumin/total globulin ratio. Prior treatment with AMP ameliorates liver function without the complete prevention of fatty liver.

3681 ACTIN-LIKE CONTRACTILE PROTEIN IN CARBON TETRACHLORIDE-INDUCED CIRRHOSIS IN THE RAT. (Eng.) Toh, B. H.; Cauchi, M. N.; Muller, H. K. (Monash Univ. Medical Sch., Praharan, Victoria 3181, Australia). *Pathology* 9(3):187-194; 1977.

The reactivity of cirrhotic livers with smooth muscle antibody (SMA) was examined, since, in cirrhosis, there is proliferation of hepatocytes and granulation tissue formation with subsequent liver shrinkage. Cryostat sections of livers from rats treated with carbon tetrachloride for 12 weeks were examined by indirect immunofluorescence for reactivity with human serum containing SMA. Increased binding of SMA serum to hepatocytes was observed as early as the first week of CCl_4 treatment and remained enhanced during the 12 weeks of study. No difference in staining intensity was observed between precirrhotic liver parenchymal cells and hepatocytes in regenerative nodules of frankly cirrhotic livers. In addition, granulation tissue fibroblasts in cirrhotic livers showed strong

reactivity with SMA serum. The specificity of the staining reaction for actin was established by its prevention on neutralization absorptions of the serum with homogenates of smooth muscle or extracts containing actin derived from smooth muscle. Circulating SMA was not demonstrated in the serum of rats at any phase of the study. The observations show that there is an increased expression of actin-like protein in regenerating hepatocytes and granulation tissue fibroblasts in cirrhotic livers.

3682 CHOLESTATIC STEROID HORMONES INHIBIT TAUROCHOLATE UPTAKE INTO ISOLATED RAT HEPATOCYTES. (Eng.) Schwarz, L. R.; Schwenk, M.; Pfaff, E.; Greim, H. (GSF, Abteilung fur Toxikologie, Gebaude 43, 8042 Neuherberg, W. Germany). *Biochem. Pharmacol.* 26(24):2433-2437; 1977.

The effect of norethandrolone, 17-β-estradiol, and progesterone on hepatocellular uptake and secretion of taurocholate was studied in isolated rat liver cells. The three cholestatic steroids decreased the rate of taurocholate uptake. Norethandrolone inhibited uptake noncompetitively with an inhibition constant (K_I) of 18 μm, but had no effect on the activation energy of uptake. 17-β-Estradiol and progesterone reduced taurocholate uptake by 50% at concentrations between 40 μM and 50 μM. The secretion of taurocholate from taurocholate-loaded cells was slightly increased by all three steroids at concentrations below 100 μM. A 60% inhibition of secretion was observed in the presence of 500 μM norethandrolone. Interference of cholestatic steroids with hepatocellular bile acid uptake may be an important step in the pathogenesis of intrahepatic cholestasis.

3683 STORAGE OF PROTEINS IN THE ROUGH ENDOPLASMIC RETICULUM OF HUMAN HEPATOCYTES IN A PATIENT WITH NORMAL BLOOD PROTEINS, ON ORAL CONTRACEPTIVES. (Eng.) Porte, A.; Batzenschlager, A.; Stoeckel, M. E.; Bockel, R.; Girard, M.; Doffoel, M. (Institut de Physiologie, Strasbourg, France). *Virchows Arch. [Pathol. Anat.]* 375(3): 241-248; 1977.

The case of a 28-yr-old woman presenting with jaundice and no evident abnormality in α_1-antitrypsin (AAT), in whom protein storage in the rough endoplasmic reticulum of the hepatocytes resembled those in AAT deficiency, is reported. The patient had been taking oral contraceptives for 4 yr. AAT and other blood protein levels were normal. Most hepatocytes contained characteristic globular inclusions, but they were PAS-negative and did not react with anti-AAT antibodies. This storage of protein ceased at the time the jaundice disappeared. Prolonged treatment with high doses of contraceptive steroids may have been involved in this peculiar reaction of the hepatocytes.

3684 MECHANISM OF ESTROGEN-INDUCED SATURATED BILE IN THE HAMSTER. (Eng.) Bonorris, G. G.; Coyne, M. J.; Chung, A.; Schoenfield, L. J. (Cedars-Sinai Medical Center, 8700 Beverly Blvd., Los Angeles, CA 90048). *J. Lab. Clin. Med.* 90(6): 963-970; 1977.

The effect of ethinyl estradiol (EE) on the biliary saturation index (SI) and on the rate-limiting hepatic enzymes of cholesterol (CH) synthesis and of bile acid (BA) synthesis was studied in male hamsters. The animals received either a standard diet or a standard diet containing EE (50 μg/kg) for 1 month. Biliary lipids were determined at sacrifice. The activities of hepatic microsomal hydroxymethyl glutaryl coenzyme A reductase (HMG-CoAR) and 7α-hydroxylase were assayed. Biliary SI in EE-treated hamsters (1.12 ± 0.04) was significantly greater ($p<0.01$) than in the controls (0.68 ± 0.03). HMG-CoAR activity with EE treatment (299 ± 12.3 pmol/mg/min) was not different from control values (300 ± 9.5 pmol/mg/min). 7α-Hydroxylase activity was less ($p<0.01$) with EE treatment (14.7 ± 1.6 pmol/mg/min) than in the controls (23.0 ± 1.1 pmol/mg/min). EE treatment did not change the amount of esterified CH in total liver tissue from control level (3.92 ± 0.16 μmol/g) or in the microsomal fraction from control level (0.034 ± 0.003 μmol/mg). EE treatment did not change hepatic BA from control values (253 ± 10.4 nmol/g). These studies indicate that the increase in SI associated with EE treatment is associated with inhibition of BA synthesis without effect on CH synthesis. The absence of EE-induced changes in hepatic CH and BA concentrations suggests that this decreased BA synthesis may result from mechanisms other than altered substrate or increased BA feedback.

3685 EFFECT OF ESTRADIOL-17β ON THE METABOLISM OF BILE ACIDS IN THE RAT. (Eng.) Ayaki, Y. (Tottori Univ. Sch. Medicine, Yonago, Tottori 683, Japan). *J. Biochem.* 82(5):1379-1388; 1977.

The effect of estradiol-17β on bile acid metabolism was studied in male rats. A 3-day acute treatment with the hormone (100 μg/100 g, s.c.) caused a decrease in serum cholesterol (from 91.8 ± 7.2 mg/dl in controls to 40.3 ± 7.6 mg/dl) and an increase in hepatic cholesterol (from 1.68 ± 0.05 to 2.62 ± 0.14 mg/g). Chronic treatment with the same quantity twice a week for 3 weeks induced hypercholesteremia (from a control level of 85.3 ± 5.8 to a level of 123.5 ± 9.9 mg/dl), which continued for 10 days after the final dosage, but there was no change in total hepatic cholesterol. Fistula bile from both groups of treated rats collected during 30 min was analyzed for bile acid components. Hyodeoxycholic acid and/or chenodeoxycholic acid increased relative to cholic acid in both groups, as compared with the controls. Kinetic study of the metabolism of bile acids in the chronically treated rats revealed a more than twofold enlargement of the pool size but an almost unchanged half-life of chenodeoxycholic acid. Essentially no change in pool size or half-life was observed for cholic acid. These results indicate that chronic treatment of male rats with estradiol-17β causes an increase in elimination of hepatic cholesterol via the bile acid pathway.

3686 THE EFFECT OF ADMINISTRATION OF ETHINYL ESTRADIOL ON HEPATOCYTE MORPHOLOGY IN THE RHESUS MONKEY. (Eng.) Wadsworth, P. F.; Kennedy, S. J.; Heywood, R. (Huntingdon Res. Center, Huntington PE18 6ES, England). *Toxicol. Lett.* 1(3): 169-174; 1977.

The effect of ethinyl estradiol administration on hepatic ultrastructure was studied in four female rhesus monkeys. The administration of ethinyl estradiol (100 μg/kg/day) for 26 weeks resulted in elevation of serum alanine aminotransferase (SALT) and serum leucine aminopeptidase values. Light microscopy showed no morphological change, but by transmission electron microscopy, hepatocytes containing needle-shaped electronlucent areas were identified in two of four treated animals, one of which had periportal hepatocytes with intracisternal sequestration of the endoplasmic reticulum. The changes in the hepatocytes were not considered to be sufficient to account for the increased SALT and LAP values. The needle-shaped electronlucent areas seen in the cytoplasm of the few hepatocytes in the two monkeys could possibly represent a cleft remaining after a crystal had been lysed out during processing.

3687 QUALITATIVE ALTERATION IN HEPATIC MICROSOMAL CYTOCHROME P-450 APOPROTEINS ASSOCIATED WITH BILE DUCT LIGATION, AND THE ADMINISTRATION OF ETHINYL ESTRADIOL, PHENOBARBITAL AND 3-METHYLCHOLANTHRENE. (Eng.) Mackinnon, A. M.; Sutherland, E.; Simon, F. R. (Flinders Medical Center, Bedford Park, South Australia 5042, Australia). *Biochem. Pharmacol.* 27(1):29-35; 1978.

Studies were carried out in livers of Sprague-Dawley rats to investigate whether different forms of cytochrome P-450 are altered in hepatic disorders associated with impaired drug metabolism. Total hepatic cytochrome P-450 was decreased after either bile duct ligation or the administration of ethinyl estradiol (5 mg/kg/day, s.c., 5 days). In contrast, phenobarbital (80 mg/kg/day, i.p., 5 days) increased hepatic content of cytochrome P-450, and when administered with ethinyl estradiol the reduction in cytochrome P-450 was prevented. Microsomal ethylmorphine *N*-demethylase activities paralleled changes in cytochrome P-450 content, except in bile duct ligation, where the activity was diminished to a greater extent. Four forms of microsomal cytochrome P-450 apoproteins, ranging in molecular weight from 50,000 to 58,000 daltons, were tentatively identified in a sodium dodecyl sulfate (SDS)-6 M urea polyacrylamide gel electrophoresis system by their responsiveness to pharmacological agents, turnover, and benzidine peroxidase staining. Phenobarbital administration increased primarily band IV (50,000 daltons); in contrast, only band III (53,000 daltons) was responsive to 3-methylcholanthrene (10 mg/kg/day, i.p., 5 days). Bile duct ligation was associated with a marked reduction in bands I, III, and IV while bands I and III were decreased with ethinyl estradiol administration. Simultaneous administration of phenobarbital and ethinyl estradiol demonstrated a return of band I and an increase in density of bands II and IV. The mechanism of this reversal by phenobarbital was determined by the double-isotope technique, which demonstrated that phenobarbital increases the relative synthesis rates of P-450 apoproteins in ethinyl estradiol-treated rats. These studies support the hypothesis that multiple forms of cytochrome P-450 are present in liver microsomal membranes and that alterations in specific apoproteins may be associated with an increase or a decrease in the functional properties of cytochrome P-450.

3688 ADAPTIVE CHANGES OF RAT LIVER CELLS INDUCED BY REPEATED INTRAPERITONEAL INJECTIONS OF D-GALACTOSAMINE. I. LIGHT MICROSCOPIC, AUTORADIOGRAPHIC AND BIOCHEMICAL STUDIES OF PARENCHYMAL ALTERATION, DNA AND RNA SYNTHESIS. (Eng.) Schuchhardt, C.; Felgenhauer, K.; Wagner, T. W.; Enzan, H.; Lesch, R. (Dept. Pathology, Univ. Freiburg, Albertstrasse 19, D-7800 Freiburg, W. Germany). *Virchows Arch. [Cell Pathol.]* 26(1):43-57; 1977.

To examine the effects of repeated D-galactosamine administration (GalN) on rat livers (i.e., the effects of subacute intoxication), Wistar rats were treated daily with GalN (250 mg/kg) after an initial injection of GalN (375 mg/kg). The interval for this investigation was between 1 hr and 30 days. After the first GalN injection, the light microscopic features of a toxic hepatitis were seen. Following daily repeated GalN injections, the amount of parenchymal necroses as well as the extent of inflammatory infiltration disappeared stepwise, indicating that during this subacute stage of intoxication the reaction pattern of the liver tissue had changed. UDP glucose as well as UDP + UTP trapping was observed 6 hr after a single GalN injection followed by values comparable to those of the controls after eight daily injections. The RNA content per gram of liver did not show any fluctuation after a single or repeated GalN injections. Using ^{3}H-cytidine as a radioactive precursor, however, RNA synthesis during the acute stage of intoxication was shown to be strongly decreased, while the following daily injections led to enhanced RNA synthesis. During the acute stage, the decreased RNA synthesis could be raised to normal values by an additional injection of unlabeled uridine. The DNA content per gram liver did not show any remarkable changes. The incorporation rates of ^{3}H-thymidine were increased three- to fourfold after daily GalN injections. The autoradiographs revealed nearly identical labeling indices of hepatocytes as well as Kupffer cells; these indices were 20- to 30-fold greater than those in controls. The findings indicate important differences between GalN-induced alterations in the acute stage of intoxication and those in the subacute stage following repeated injections. These differences may be explained as an adaptation to repeated GalN intoxication.

3689 AGE DEPENDENT KINETIC STUDIES OF CYTOPLASMIC AND LYSOSOMAL ENZYMES OF THE NORMAL AND D-GALACTOSAMINE INJURED RAT LIVER. (Eng.) Platt, D.; Forster, K.; Forster, L. (Center Inter-

nal Medicine, Justus Liebig-Univ. Giessen, W. Germany). *Mech. Ageing Dev.* 7(3):183-188; 1978.

Studies were carried out in female SIV rats of two age groups (6 weeks and 30 months) to determine if there are age-dependent differences in the development and treatment of galactosamine hepatitis. The rats received (a) a single dose of D-galactosamine (GalN, 600 mg, i.p.) or (b) a single dose of GalN as in (a) plus prednisolone (20 mg/kg, s.c.) at the beginning of the experiment. The kinetic studies disclosed that GalN produced more severe changes in old than in young animals, represented by the activities of cytoplasmic (SGOT and SGPT) and lysosomal (β-acetylglucosaminidase, β-glucuronidase, cathepsin D) enzymes. Prednisolone diminished the morphological liver changes as well as the biochemical disturbances in young rats. There was only a protecting effect in morphological changes of old animals within the first 12 hr. The prevention of cytoplasmic enzyme activity increase was limited to the first 12 hr. These studies show that morphological and biochemical alterations are more severe in old than young animals.

3690 ROLE OF URIDINE ENTRAPPED IN LIPOSOMES IN GALACTOSAMINE-INDUCED HEPATITIS. (Eng.) Mathias, C.; Dorai, D. T.; Bachhawat, B. K. (Christian Medical Coll. Hosp., Vellore 632 004, India). *Ind. J. Biochem.* 14(2):142-146; 1977.

The therapeutic value of using the liposomes to deliver substances to liver cells was studied in galactosamine-induced hepatitis. A single i.p. injection of D-galactosamine to female rats produced morphological changes in the liver that closely resembled those observed in human viral hepatitis. The damage was dose-dependent. The dose of D-galactosamine required to produce minimal liver glycogen levels (1.5 ± 0.9 mg/g) was 75 mg/kg. The i.v. administration of free uridine (0.04 mg/g) 30 min after the injection of D-galactosamine (75 mg/kg) slightly decreased the glycogen depletion, resulting in values of 6.4 ± 1.1 mg/g of liver tissue. The same dose of uridine entrapped in three different types of liposomes was then administered to rats treated with the standard dose of D-galactosamine. Animals treated with liposomes containing either stearylamine or dicetylphosphate failed to produce a protective effect on the liver glycogen levels (0.8 ± 0.2 mg/g and 5.1 ± 1 mg/g, resp.) and liver morphology. In contrast, animals receiving phosphatidic acid-containing liposomes showed a marked regeneration of liver glycogen (25 ± 9 mg/g). The liver morphology was restored to near normal in the animals treated with phosphatidic acid-containing liposomes. The liposomes may be of value for transporting substances to the hepatocytes in the treatment of viral hepatitis.

3691 MALIGNANT TUMORS IN RATS FED NAFENOPIN, A HEPATIC PEROXISOME PROLIFERATOR. (Eng.) Reddy, J. K.; Rao, M. S. (Northwestern Univ. Medical Sch., Chicago, IL 60611). *J. Natl. Cancer Inst.* 59(6):1645-1650; 1977.

The carcinogenicity of the hypolipemic hepatic peroxisome proliferator, nafenopin (2-methyl-2-[*P*-(1,2,3,4-tetrahydro-1-naphthyl)phenoxy]propionic acid; Su-13,437) was tested in 15 male F344 rats. The animals received nafenopin at a dietary concentration of 0.1% until the end of the experiment at 25 months. Between 18 and 25 months, 12 of 15 rats developed tumors. Eleven of the 15 rats developed hepatocellular carcinomas, and 3/15 developed pancreatic acinar cell tumors, including 1 metastasizing carcinoma. The hepatocellular carcinomas as well as the acinar cell carcinoma of the pancreas were successfully transplantable through six generations. These studies confirm the carcinogenicity of nafenopin in F344 rats.

3692 HEPATOTOXICITY OF SALICYLATES IN MONOLAYER CELL CULTURES. (Eng.) Tolman, K. G.; Peterson, P.; Gray, P.; Hammar, S. P. (Univ. Utah Coll. Medicine, 50 N. Medical Drive, Salt Lake City, UT 84132). *Gastroenterology* 74(2, Part 1):205-208; 1978.

The influence of graded doses of sodium salicylate (10, 20, 30, 40, and 50 mg/dl) on rat liver cells cultured in monolayers was assessed by measuring lactic dehydrogenase activity in culture media after cell incubation. Morphological alterations were studied by electron microscopy. The influence of different albumin concentrations in the media on toxicity was also evaluated. Lactic dehydrogenase concentrations rose with increasing doses of salicylate up to 40 mg/dl. High albumin concentrations were associated with reduced salicylate toxicity. These findings suggest that salicylate-induced hepatic injury is dose related and may be influenced by serum albumin levels.

3693 EFFECT OF ACUTE UREMIA ON ARGININE METABOLISM AND UREA AND GUANIDINO ACID PRODUCTION BY PERFUSED RAT LIVER. (Eng.) Perez, G. O.; Rietberg, B.; Owens, B.; Schiff, E. R. (Miami Veterans Admin. Hosp., 1201 N.W. 16th St., Miami, FL 33125). *Pfluegers Arch.* 372(2):275-278; 1977.

The effect of an acute loss of renal function on the hepatic metabolism of arginine and other urea cycle intermediates was investigated. Since arginine is a precursor of urea and other guanidino derivatives, its metabolism was studied in acute uremia using the isolated perfused rat liver. Female Sprague-Dawley rats underwent bilateral nephrectomy or sham operation 48 hr prior to liver perfusion. [Gaunidino ^{14}C]arginine (50 μCi) and unlabeled arginine and aspartic acid were added to the recycling perfusate 15 min prior to liver perfusion. Perfusate concentrations of urea and other guanidino derivatives were measured with high-pressure liquid chromatography. After the initial 30 min of perfusion, net uptake of arginine was lower, and net release of guanidino-succinic acid (GSA) was higher in the livers of acutely uremic rats. Net release of urea was also higher in uremia but the results did not achieve statistical significance. In uremia, the percentage conversion

of ^{14}C arginine to ^{14}C urea was significantly ($p < 0.05$) higher (79 ± 5%) than in controls (58 ± 7%). These results demonstrate increased GSA production by livers of acutely uremic rats and suggest that acute uremia may be associated with increased arginine utilization and increased production of urea.

3694 ALTERATIONS OF RAT LIVER SUBSEQUENT TO HEAT OVERLOAD. (Eng.) Bowers, W. D., Jr.; Hubbard, R. W.; Leav, I.; Daum, R.; Conlon, M.; Hamlet, M. P.; *et al.* (US Army Res. Inst. Environmental Medicine, Natick, MA 01760). *Arch. Pathol. Lab. Med.* 102(3):154-157; 1978.

Specimens were taken from the liver in male Sprague-Dawley rats during a study to assess the rat as a model for human heat stroke. Tissues from four groups of rats were processed for light and electron microscopy. The groups consisted of control rats, rats run to exhaustion at 5 C, rats exhausted at 26 C, and rats restrained at 41.5 C until their rectal temperatures reached 42.3 C. Exhaustive exercise at 5 C produced neither fatalities nor pathological changes in the livers. Exhaustive exercise at 26 C and restraint at 41.5 C were fatal for most rats. Histological and/or ultrastructural changes, which included centrilobular necrosis, vacuolization and diminution of hepatocellular microvilli, and loss of sinusoidal endothelium, were observed in livers from rats that were run to exhaustion at 26 C and from those rats restrained at 41.5 C. This work supports the validity of the rat model, since human heat stroke results in similar hepatic changes.

3695 CONTROL OF ASCITES ABSORPTION IN ANESTHETIZED CATS: EFFECTS IN INTRAPERITONEAL PRESSURE, PROTEIN, AND FUROSEMIDE DIURESIS. (Eng.) Zink, J.; Greenway, C. V. (Faculty Medicine, Univ. Manitoba, 770 Bannatyne Ave., Winnipeg, Manitoba R3E 0W3, Canada). *Gastroenterology* 73(5):1119-1124; 1977.

A plethysmographic technique was utilized to record the rate of absorption of fluid from the peritoneal cavity of anesthetized cats. In 33 cats, the rate of fluid absorption from the peritoneal cavity was directly proportional to the intraperitoneal pressure regardless of whether the intraperitoneal fluid was free from protein or contained a protein concentration equivalent to that of plasma. Fluid was absorbed with a protein concentration equivalent to that present in the peritoneal cavity. Thus, the intraperitoneal pressure is apparently an important factor controlling the accumulation of ascitic fluid, but the protein concentration of the intraperitoneal fluid does not affect the rate of reabsorption. In addition, marked diuresis induced by i.v. furosemide (3.1 mg/kg) did not appear to mobilize ascites by an effect on the reabsorption process.

3696 IMMUNOFLUORESCENCE MICROSCOPY IN EXPERIMENTALLY INDUCED, TYPE B HEPATITIS IN THE CHIMPANZEE. (Eng.) Hoofnagle, J. H.; Michalak, T.; Nowoslawski, A.; Gerety, R. J.; Barker, L. F. (Veterans Admin. Hosp., 50 Irving St., N.W., Washington, DC 20422). *Gastroenterology* 74(2, Part 1):182-187; 1978.

Sequential liver biopsies from five chimpanzees with experimentally-induced, acute type B hepatitis were studied for immunofluorescence (IF) reactivity. In general, IF for hepatitis B surface antigen (HBsAg) and hepatitis B core antigen (HBcAg) appeared early in the course of the infection, shortly after the first appearance of HBsAg in the serum, and well before the onset of elevated transaminase values and light microscopy histopathological changes on liver biopsies. IF reactivity usually disappeared at the time of peak transaminase elevations and liver cell morphological changes, but before the disappearance of serum HBsAg. The pattern of IF reactivity, whether predominantly HBsAg or HBcAg or both, remained constant over the course of the infection for any one chimpanzee and did not appear to be correlated with clinical severity or the presence or absence of the hepatitis B virus-related e antigen. The occurrence of peak liver enzyme elevation and clinical disease at the time of disappearance or diminution of hepatic HBsAg and HBcAg expression, and not at the time of peak in IF reactivity, is consistent with the concept that tissue injury in type B hepatitis is not the result of a direct cytopathic effect of the virus, but is rather the result of an indirect, host-mediated effect involved in the immune clearance of these viral antigens.

3697 INHIBITORY EFFECTS OF JAUNDICE ON REGENERATING LIVER. (Eng.) Yamamoto, M.; Yamada, T.; Ida, T.; Ozawa, K. (Kyoto Univ., Faculty Medicine, 54-Kawaramachi, Shogoin, Sakyo-ku, Kyoto 606, Japan). *Res. Exp. Med. (Berl.)* 171(2):121-128; 1977.

The effects of partial hepatectomy on energy charge (ATP+1/2ADP/ATP+ADP+AMP) and mitochondrial oxidative phosphorylation were studied in normal and jaundiced Wistar rats. In normal rats the energy charge levels of the remnant liver decreased only slightly with a rise in the phosphorylative activity of the mitochondria at an early stage after hepatectomy, and then rapidly returned to normal. In rats in which jaundice was induced by common bile duct ligation, the energy charge levels of the liver decreased to approximately 0.800 from a normal value of about 0.849, although their mitochondrial oxidative phosphorylation was within normal limits. In jaundiced rats, the energy charge levels of the remnant liver after partial hepatectomy decreased markedly without a return toward normal. The mitochondrial phosphorylative activity increased to only about 50% of hepatectomized normal rats after partial hepatectomy. More than 70% of jaundiced rats died within 24 hr after partial hepatectomy. It is suggested that jaundice inhibits the enhancement of mitochondrial ATP generation that is usually seen in regenerating liver and that is necessary to provide sufficient energy for the energy-requiring biosynthetic process as in the early process of liver regeneration.

3698 EFFECT OF CHRONIC RENAL FAILURE IN RATS ON STRUCTURE AND FUNCTION OF THE HEPATIC ENDOPLASMIC RETICULUM. (Eng.) Black, M.; Biempica, L.; Goldfischer, S.; Grossman, S.; Arias, I. M. (Temple Univ. Sch. Medicine, 3420 N. Broad St., Philadelphia, PA 19140). *Exp. Mol. Pathol.* 27(3): 377-391; 1977.

To determine whether features associated with the uremic syndrome in liver disease could be related to changes in the function of the hepatic endoplasmic reticulum, functional, histochemical, and ultrastructural studies of the liver were performed in rats rendered chronically azotemic following unilateral nephrectomy and segmental infarction of the remaining kidney. Zoxazolamine paralysis time (6.6 ± 0.3 hr) and ketamine narcosis time (50.0 ± 3.0 min) in rats with renal failure were prolonged in comparison with sham operated controls (4.2 ± 0.2 hr and 40.2 ± 4.3 min, resp.; $p<0.01$ and $p>0.01$, resp.). Cytochrome P-450 content and benzphetamine and aminopyrine demethylase activities were decreased in the animals with renal failure, and *o*-aminophenol uridine diphosphate-glucuronyl transferase activity was unaltered. Histochemical examination of the liver by light microscopy revealed little abnormality except for lipid accumulation associated with increased serum cholesterol and triglyceride concentrations. Electron microscopy demonstrated alterations in endoplasmic reticulum and lysosomes. Dichloroethane treatment of uremic rats prevented the ultrastructural changes and enhanced drug metabolizing enzyme systems. These observations indicate that experimental chronic renal failure influences the structure and function of the hepatic endoplasmic reticulum and support the hypothesis that some features of the uremic syndrome in man may result from altered hepatic subcellular function.

3699 STUDIES ON THE EFFECT OF LONG-TERM EXPOSURE TO NITROGEN DIOXIDE ON SERUM AND LIVER PROTEINS LEVEL AND ENZYME ACTIVITY IN GUINEA PIGS. (Eng.) Drozdz, M.; Kucharz, E.; Ludyga, K.; Molska-Drozdz, T. (Silesian Medical Sch., Sosnowiec, Poland). *Eur. J. Toxicol.* 9(5):287-293; 1976.

3700 THE IMPORTANCE OF BICARBONATE TRANSPORT IN THE BILE SALT INDEPENDENT FRACTION (BSIF) OF CANALICULAR BILE FLOW [Abstract]. (Eng.) Hardison, W. G.; Wood, C. A. (Veterans Admin. Hosp., San Diego, CA). *Gastroenterology* 73(5):1223; 1977.

3701 ESTIMATING HEPATIC TRANSFER COEFFICIENTS FROM THE PLASMA DISAPPEARANCE CURVE: THE ERRORS INVOLVED IN ASSUMING HOMOGENEOUS COMPARTMENTS [Abstract]. (Eng.) Forker, E. L.; Luxon, B.; Gibson, J. (Dept. Medicine, Univ. Iowa, Iowa City, IA). *Gastroenterology* 73(5):1220; 1977.

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See also, 3474, 3535, 3540, 3541, 3615, 3629, 3797, 3820, 3828, 3830, 3839, 3853, 4132, 4155, 4191, 4231, 4232.

SECRETION AND METABOLISM

Intestine

3759 TANNIC ACID AND OXIDIZED TANNIC ACID ON THE FUNCTIONAL STATE OF RAT INTESTINAL EPITHELIUM. (Eng.) Mitjavila, S.; Lacombe, C.; Carrera, G.; Derache, R. (INSERM- U.87, Institut de Physiologie, 2 Rue Francois Magendie 31400, Toulouse, France). *J. Nutr.* 107(12):2113-2121; 1977.

To ascertain the origin of fecal nitrogen and the effect of tannic acid on the intestinal mucosa, diets containing tannic acid (3% of dry matter) were fed to male Wistar rats for 33 days. To explain the effect of oxidation of tannins, diets containing oxidized tannic acid or tannic acid associated with an antioxidant (sodium sulfite) at the level of 1% of dry matter were also administered. The increased excretion of sialic acid (from

2.209 ± 0.0583 to 3.03 ± 0.140 g, $p<0.001$) and glucosamine (from 0.215 ± 0.0147 to 0.400 ± 0.0139 g, $p<0.001$) during tannic acid ingestion indicated that the excess of fecal nitrogen mainly corresponds to the mucus hypersecretion observed by histology. Fecal analysis revealed perturbations in movements of water and ions. The study of the metabolic activity of isolated enterocytes and the activity of some enzymes in a homogenate of these cells showed an inhibition of oxygen consumption and succinic dehydrogenase activity. The addition of sodium sulfite to the diet had little effect on the action of tannic acid; however, the addition of previously oxidized tannin reduced the effects observed, particularly in the case of fecal nitrogen loss.

3760 SYNTHESIS OF MACROMOLECULES BY INTESTINAL CELLS INCUBATED WITH AMMONIA. (Eng.) Topping, D. C.; Visek, W. J. (Biology Div., Oak Ridge Natl. Lab., P.O. Box Y, Oak Ridge, TN 37830). *Am. J. Physiol.* 233(4):E341-E347; 1977.

Studies were conducted to determine whether concentrations of ammonia normally present in the intestinal tract of mammals and birds alter synthesis of macromolecules in isolated intestinal epithelial cells and to gain information about the possible role of ammonia in determining the RNA and DNA content of intestinal cells when animals are maintained in a conventional environment. Mucosal cells isolated from the small intestine of chicks and rats were incubated with ammonia (10 mM). NH_4Cl treatment increased glucose metabolism in cells from both species. Ammonia stimulated incorporation of precursors into RNA and decarboxylation of orotic acid by cells isolated from chickens, but an increase in incorporation of precursors into DNA was not observed in cells from either species. Cultured embryonic chicken duodena showed increased incorporation of orotate into RNA with NH_4Cl added to the medium. Rats immunized against jack bean urease showed lower urease activity per gram of dry intestinal content, lower intestinal weight, lower mucosal cell and total gut protein, and less protein per unit weight of DNA in the mucosal cell fraction. The results support the conclusion that ammonia produced in the intestine by bacterial ureases causes significant changes in the content of RNA and protein in intestinal cells.

3761 EFFECTS OF COLCHICINE TREATMENT ON RAT INTESTINAL DISACCHARIDASE ACTIVITIES. (Ger.) Hartwich, G.; Broll, R.; Domschke, W. (Medizinische Universitatsklinik Erlangen, D-852 Erlangen, W. Germany). *Exp. Pathol. (Jena)* 13(4/5):198-208; 1977.

The effect of colchicine treatment on maltase, lactase, β-fructofuranosidase, and cellobiase activities in the jejunal mucosa was studied in male Wistar rats free of specific pathogens. Colchicine was administered i.p. in single doses of 1 or 0.5 mg/kg or in five 0.1 mg/kg-doses at 24-hr intervals. The enzyme activities were measured at 24-hr intervals from the first until the 10th or 14th day, and were related to the tissue protein content. Both regimens of colchicine caused significant ($p<0.001$-0.01) reduction of all enzyme activities, which failed to return to normal during the observation period. The first decline in the enzyme activities lasted until the 2nd or 3rd day after administration, which was followed by an increase between days 2 and 3 or 3 and 4 and then a second drop. These considerable reductions of the enzyme activity were accompanied by slight microscopic changes only. Hydropic swelling of the cryptic cells was seen after 24 hr, partly associated with granular disorganization of the cytoplasm, necrosis of single cells, depletion of mucus in the goblet cells, and edema of the villous stroma. The crypts were enlarged. Mitoses were only seldom seen. The profile of the enzyme activities demonstrated the double action of colchicine (direct toxic injury of the enzymes in the differentiated cells of the villi and reduced supply of enzymes by the crypts due to the inhibiting action on mitosis), and the findings support the hypothesis that the cells developing by enhanced proliferation during the recovery phase have a still incomplete enzyme system. This latter fact may be the cause of the delayed restoration of the enzyme activities compared to the progress in morphological restoration. The findings indicate that colchicine treatment may cause reversible maldigestion of dietary disaccharides in man.

3762 PARALLEL BETWEEN CIRCADIAN RHYTHMS OF INTESTINAL DISACCHARIDASES AND FOOD INTAKE OF RATS UNDER CONSTANT LIGHTING CONDITIONS. (Eng.) Nishida, T.; Saito, M.; Suda, M. (Ehime Univ. Sch. Medicine, Shigenobu, Onsen-gun, Ehime 791-02, Japan). *Gastroenterology* 74(2, Part 1): 224-227; 1978.

The relationship between the circadian rhythmic changes in the disaccharidase activities of the small intestine and the circadian feeding pattern was investigated in male Wistar rats kept in the dark or in the light continuously for 4 weeks. Rats kept continuously in the light and fed *ad libitum* showed no rhythmic change in food intake or disaccharidase activities, but when they were only fed during a restricted time of day (9 AM to 3 PM), their disaccharidase activities showed rhythmic changes with higher activities around the feeding time. In contrast, rats kept continuously in the dark and fed *ad libitum* showed circadian variations in food intake and disaccharidase activities essentially similar to rats kept under the normal light-dark lighting schedule. These findings show that the rhythm of disaccharidase activities is synchronized with the feeding rhythm, not with the lighting rhythm.

3763 BRUSH BORDER PEPTIDASES AND ARYLAMIDASES IN THE EXPERIMENTAL BLIND LOOP SYNDROME OF THE RAT. (Eng.) Mazzacca, G.; Musella, S.; Andria, G.; D'Agostino, L.; Cimino, L.; Budillon, G. (Nuovo Policlinico, Via S. Pansini, I-80131, Napoli, Italy). *Acta Hepatogastroenterol. (Stuttg.)* 24(5):364-367; 1977.

Peptidase and arylamidase activities were assessed in purified brush borders from the jejunum of Wistar rats with surgically created blind loops and in controls. The blind loop segment and the jejunum proximal and distal to the blind loop were studied. The blind loop syndrome was documented by the presence of macrocytic anemia. In rats with the blind loop syndrome, enzymatic activities that hydrolyze sucrose, L-leucyl-beta-naphthylamide, L-lysyl-beta-naphthylamide, alpha-L-glutamyl-beta-naphthylamide, L-phenylalanylalanine, and L-leucyl-glycine were significantly reduced as compared to those in controls ($p<0.001$). After a short course of antibiotic therapy (chloramphenicol, 100-150 mg/day, 7 days, p.o.), enzymatic activities returned to normal. These findings suggest that intestinal mucosal damage in rats with the blind loop syndrome is reversible.

3764 INDUCTION OF Na-K-ATPase IN PLASMA MEMBRANES OF RAT CECUM MUCOSA BY DIET: TIME COURSE AND KINETICS. (Eng.) Schiffl, H.; Loeschke, K. (Medizinische Klinik Innenstadt der Universitat Munchen, Ziemssenstrasse 1, D-8000 Munchen 2, W. Germany). *Pfluegers Arch.* 372(1):83-90; 1977.

Using cecum mucosa homogenates and cellular subfractions of male SPF Wistar rats, obtained by differential centrifugation, the process by which dietary polyethylene glycol (PEG) induces cecal Na^+-K^+-activated adenosine triphosphatase (Na-K-ATPase) activity was studied with respect to time course, subcellular distribution, and properties of the enzyme. In comparison with controls, Na-K-ATPase specific activity was stimulated in PEG-treated (160 g/l in drinking water) rats in the total homogenate and in the microsomal (105,000 x *g*) sediment but not in the mitochondrial (9,000 x *g*) or nuclear (1,000 x *g*) sediment. The specific activity of Mg-ATPase did not change in any of the fractions. Na-K-ATPase induction was statistically significant after 2 days and complete after 1-2 weeks, in parallel with the previously described stimulation in net sodium absorption. Kinetic analysis showed V_{max} for ATP to be doubled while K_m for ATP, Na, and K as well as the optimal Mg/ATP ratio and K_i for ouabain remained unchanged. It is proposed that Na-K-ATPase and active sodium transport are closely associated in rat cecum and that dietary Na-K-ATPase stimulation is due to the induction of more enzyme molecules per unit basolateral cell membrane.

3765 ESTIMATION OF CHOLECYSTOKININ-PANCREOZYMIN (CCK) IN HUMAN PLASMA AND TISSUE BY A SPECIFIC RADIOIMMUNOASSAY AND THE IMMUNOHISTOCHEMICAL IDENTIFICATION OF PANCREOZYMIN-PRODUCING CELLS IN THE DUODENUM OF HUMANS. (Eng.) Schlegel, W.; Raptis, S.; Grube, D.; Pfeiffer, E. F. (Dept. Internal Medicine, Univ. Ulm, Ulm, W. Germany). *Clin. Chim. Acta* 80(2):305-316; 1977.

A reliable, sensitive, reproducible, and specific radioimmunoassay for cholecystokinin-pancreozymin (CCK), using rabbit antisera to highly purified porcine hormone, is described, and the assay was tested in humans. The naturally occurring variant of CCK (39-CCK, in which the ordinary CCK is lengthened from its *N*-terminus by a hexapeptide), labeled with ^{125}I and repurified by column chromatography on Sephadex G-10 and on SP-Sephadex C-25, was used as tracer. Separation of CCK from antibody-bound labeled 39-CCK was carried out using a double-antibody procedure. Nonspecific interference with the assay system was abolished by ethanol extractions. Highly purified porcine CCK was used as standard. No significant cross-reaction was found with gastrin, motilin, vasoactive polypeptide, gastric inhibitory polypeptide, natural and synthetic secretin, pancreatic glucagon, or insulin. The sensitivity of the assay is approximately 40 pg/ml of test solution. The mean plasma immunoreactive CCK concentration in 45 fasting normal subjects was 222 pg/ml, increasing after food ingestion to 480 pg/ml. Somatostatin abolished the stimulated CCK release. Elevated CCK concentrations were found in chronic pancreatitis. Immunohistochemical identification of pancreozymin cells was carried out either in surgical samples or in biopsy material. Approximately 1,650 CCK cells per cross-section were found in the human duodenum. The CCK cells usually appeared elongated, oval, or pyramidal in shape and were observed to reach the lumen with their apical cell pole. Further studies are required to elucidate the regulation mechanisms of pancreozymin release and its biological action.

3766 STUDIES ON THE RELEASE OF EXTRA-ANTRAL GASTRIN: EVIDENCE OF VAGAL INHIBITION IN THE DOG. (Eng.) Wheeler, M. H.; Bhattacherjee, S.; Psaila, J. V.; McLeish, A. R.; Poxom, V.; Owens, C.; *et al.* (Llandough Hosp., Nr. Penarth, S. Glam, Cardiff CF6 1XX, Wales). *World J. Surg.* 1(5):639-646; 1977.

The effect of resecting the gastrin-containing tissues of the antrum on basal and postprandial levels of serum gastrin was investigated in dogs. The effects of duodenal perfusion with saline and acetylcholine, and the effect of transthoracic vagotomy on serum gastrin concentrations were also investigated. Serum gastrin concentration was measured in three dogs after a meat meal; basal levels rose significantly after 10 min. After antrectomy with a Billroth I (BI), and later a Billroth II (BII) anastomosis, the basal gastrin levels were unchanged, but the rise after meat feeding was abolished. Four antrectomized dogs with a BII anastomosis and cannulae in both the duodenum and stomach were used to examine the effect of duodenal perfusion on serum gastrin. Whether the perfusate was 150 mM NaCl, 150 mM HCl, or 0.1% acetylcholine, the mean serum gastrin levels did not differ significantly from basal levels. Transthoracic vagotomy in antrectomized dogs produced a significant rise in basal gastrin levels (from 21 ± 3 pg/ml to 48 ± 3 pg/ml, $p<0.005$), but did not restore the response to a meat meal or duodenal perfusion. Parallel studies were conducted in six antrectomized, vagotomized patients who had undergone

Roux-en-Y conversion for postgastrectomy bilious vomiting, and in two patients after total gastrectomy. Duodenal perfusion via duodenostomy tubes with 150 mM NaCl, 150 mM HCl, fat emulsion, and an amino acid mixture did not raise serum gastrin above basal levels. Since meat feeding and duodenal perfusion in antrectomized dogs and humans failed to stimulate a rise in serum gastrin, the intestinal phase of gastric secretion is probably mediated by gastrin. The results following vagotomy in the dog suggest that extragastric basal gastrin release is vagally inhibited or that vagotomy interferes with the catabolic destruction of gastrin.

3767 CHANGES IN THE STRUCTURAL LOCALIZATION OF GLYCOGEN DURING GLUCOSE RESORPTION. (Ger.) Varkonyi, T.; Wittmann, T.; Karacsony, G.; Varro, V. (I. Medizinische Universitatsklinik, H-6701 Szeged, Hungary). *Z. Gastroenterol.* 15(9):565-571; 1977.

To investigate quantitative changes in the glycogen granula contents of the small intestinal mucosa, the localization of glycogen in the jejunal wall was studied during glucose resorption in 10 fasting dogs with isolated jejunal loops using light microscopy with Best-carmine staining. Isotonic glucose solution was introduced into the jejunal lumen. Glycogen was detected in the form of red granules in a patchy arrangement in the supranuclear cytoplasmic region of the enterocytes during the initial phase of the glucose resorption. About 15 min after the beginning of resorption, glycogen also appeared in steadily increasing quantities in the lamina propria. The injection of glucagon (50-100 µg/15 min) into the artery of the intestinal loop during glucose resorption caused the total disappearance of glycogen from the enterocytes, but the glycogen load of the lamina propria cells remained unchanged. The findings indicate that the epithelial cells of the small intestine are the primary target of glucagon.

3768 THE DIGESTION AND TRANSMISSION OF LABELLED IMMUNOGLOBULIN G BY ENTEROCYTES OF THE PROXIMAL AND DISTAL REGIONS OF THE SMALL INTESTINE OF YOUNG RATS. (Eng.) Morris, B.; Morris, R. (Dept. Zoology, Univ. Nottingham, University Park, Nottingham NG7 2RD, England). *J. Physiol. (Lond.)* 273(2):427-442; 1977.

The breakdown products produced by the digestive activities of the proximal and distal regions of the small intestine of suckling Wistar rats were investigated to provide information on the functional differences between proximal and distal enterocytes. Density gradient centrifugation of samples prepared from proximal gut homogenates after intralumenal injection of ^{125}I-labeled IgG was used to prepare batches of IgG fragments according to sedimentation coefficients. The radioactivity in the vascular compartments, viscera, and carcasses of rats aged 14-15 days, was partitioned using ultrafiltration 2 hr after the injection of labeled IgG into the proximal and distal regions of the small intestine. Radioactive samples prepared by these methods were reintroduced into young rats by intracardiac injection, and the rate at which they were removed from the vascular compartment was assessed. Proximal enterocytes transmitted about 39% of the IgG that had been removed from the intestine in intact form. Most of this was retained in the vascular compartment; they degraded up to about 57% of the total removed into fragments less than 1,000 in molecular weight and about 4% into intermediate-sized fragments. Distal enterocytes degraded almost 90% of the IgG processed into fragments less than 1,000 in molecular weight, and about 8% into fragments greater than 100,000 in molecular weight. Fragments of all sizes were cleared rapidly from the circulation into the viscera and carcass. The results show that, even in the absence of peptic digestion, the proximal and distal enterocytes contain efficient mechanisms for digesting protein.

3769 IMMUNOCYTOCHEMICAL AND HISTOCHEMICAL STUDIES ON INTESTINAL EPITHELIAL CELLS PRODUCING BOTH LYSOZYME AND MUCOSUBSTANCE. (Eng.) Montero, C.; Erlandsen, L. (Dept. Anatomy, Univ. Minnesota, Minneapolis, MN 55455). *Anat. Rec.* 190 (1):127-142; 1978.

The existence of lysozyme mucus-producing cells was investigated in both the rat and human intestine. The simultaneous demonstration of lysozyme (using the unlabeled antibody enzyme method) and mucosubstances (by staining with the PAS and Alcian Blue pH 2.5 techniques) led to the identification of a new subpopulation of mucus-producing cells containing lysozyme in small intestinal specimens from normal rats and from patients with inflammatory bowel diseases. These cells, containing both mucosubstances and lysozyme, were located in the lateral walls of the crypts of Lieberkuhn, but were occasionally found also in or near the tips of the villi. The specific staining for lysozyme was observed in the apical and/or basal cytoplasm of these mucus-producing cells and was readily detected in sections counterstained for mucosubstances with Alcian Blue. The localization of these mucus-producing cells was similar both in the normal rat and in the pathological human specimens. Absorption controls and controls where a nonimmune serum was substituted for the specific antilysozyme serum confirmed the specificity of the lysozyme localization.

3770 NUCLEIC ACID AND PROTEIN CONTENT OF RAT CECUM MUCOSA IN DIETARY ADAPTATION-GROWTH BY CELLULAR HYPERPLASIA. (Eng.) Loeschke, K.; Resch, W. (Medizinische Klinik Innenstadt der Universitat Munchen, Ziemssenstrasse 1, D-8000 Munchen 2, W. Germany). *Pfluegers Arch.* 372(1):91-94; 1977.

DNA, RNA, and protein content of the isolated cecum mucosa was determined in control rats and rats with adaptive cecum growth induced by dietary polyethylene glycol (administered in drinking water at 160 g/l). Feeding the polymer resulted in an increase

in the total amount of mucosal nucleic acids and protein that was statistically significant after 2-4 days and reached twice the control value after 2 months. During growth, the protein/DNA, protein/RNA, and RNA/DNA ratios remained unaltered, indicating hyperplasia and not hypertrophy of the epithelial cells. The water content of the mucosa increased from 75% to 81% during adaptation, possibly related to the stimulation in active sodium transport reported earlier. Recalculation of parallel Na-K-ATPase data on the basis of DNA content demonstrated a doubling of Na-K-ATPase activity per mg DNA in the fully adapted cell.

3771 SITE OF INTESTINAL DIPEPTIDE HYDROLYSIS. (Eng.) Wiseman, G. (Physiology Dept., The Univ., Western Bank, Sheffield S10 2TN, England). *J. Physiol. (Lond.)* 273(3):731-743; 1977.

The effects of 12 dipeptides and their free amino acids on the active transport of D-glucose across the mucosa of sacs of everted hamster small intestine were studied to determine the cellular site of final hydrolysis of the dipeptides. All dipeptides had a partially inhibitory effect on the active transport of D-glucose (5.55 mM) when present at initial concentrations of 5 mM (except prolylglycine, which had an inhibitory action at a 10 mM initial concentration). Marked inhibition occurred with glycyl-L-alanine, L-alanyl-L-alanine, and L-leucyl-L-alanine, all of which reduced the final D-glucose concentration ratio to about 60% of control values. Experiments that compared the effectiveness of each dipeptide with the effectiveness of its constituent free amino acids in suppressing D-glucose active transport permitted the classification of the dipeptides into two categories. Class 1 dipeptides (L-alanyl-glycine, glycyl-glycine, L-valyl-L-valine, L-alanyl-L-valine, L-valyl-L-alanine, and L-prolylglycine) were either more effective or less effective than their component amino acids at identical concentrations. It is suggested that these dipeptides are hydrolyzed beyond the locus of the active transport mechanism for D-glucose (i.e., the brush border or outer cell surface) and they are designated deep dipeptides; their locus of hydrolysis is perhaps within the cell. In contrast, L-alanyl-L-alanine, L-leucyl-L-leucine, glycyl-L-alanine, L-alanyl-L-leucine, L-leucyl-L-alanine, and glycyl-L-proline were only as effective in suppressing D-glucose active transport as equimolar amounts of their respective amino acids. The locus of hydrolysis of these six dipeptides is suggested to be superficial to the locus of the D-glucose active transport mechanism (i.e., that both events occur near the surface). These latter dipeptides are designated as class 2, superficial dipeptides. Since all the dipeptides partially inhibited D-glucose active transport, more than one mechanism for active sugar absorption may exist; further studies are needed to investigate these questions.

3772 CHARACTERISTICS OF POTASSIUM SECRETION IN THE MAMMALIAN COLON. (Eng.) Bastl, C.; Kliger, A. S.; Binder, H. J.; Hayslett, J. P. (Yale Univ. Sch. Medicine, New Haven, CT 06510). *Am. J. Physiol.* 234(1):F48-F53; 1978.

The characteristics of potassium transport in the colon were analyzed by determining the forces governing potassium movement, the influence of flow rate on net movement, and the response to acute and chronic changes in potassium balance in Sprague-Dawley rats. There was no evidence for active potassium transport since, under steady-state conditions, the secretion occurs down an observed electrochemical gradient that was not statistically different from the predicted value. The secretion rate rose promptly in response to acute hyperkalemia and fell to zero net movement in chronic potassium deficiency. In contrast to the renal distal tubule, potassium secretion in the colon is not flow dependent. In further experiments designed to examine overall transport characteristics in the colon, sodium was shown to be absorbed against an electrochemical gradient of approximately 60 mV, and water permeability and sodium transport in the colon was not increased by vasopressin. The rate of sodium absorption in the colon, unlike the distal tubule, is not flow dependent.

3773 ENDOGENOUS ACID RELEASES SECRETIN IN MAN. (Eng.) Domschke, W.; Greenberg, G. R.; Domschke, S.; Bloom, S. R.; Mitznegg, P.; Sprugel, W.; *et al.* (Dept. Medicine, Univ. Erlangen-Nurnberg, Krankenhausstr. 12, D-8520 Erlangen, W. Germany). *Acta Hepatogastroenterol. (Stuttg.)* 24(5):362-363; 1977.

The effect of gastric acid secretion on secretin release was investigated in six healthy volunteers. Pentagastrin (1.5 μg/kg/hr i.v.) was administered with and without aspiration of gastric contents, and plasma secretin was estimated by radioimmunoassay. Pentagastrin administration with continuous aspiration produced no change in plasma secretin immunoreactivity. Pentagastrin administration without aspiration of gastric juice resulted in a steadily increasing plasma secretin level, which was significantly elevated ($p<0.05$) at the end of 60 min of pentagastrin infusion and also in the postinfusion hour. These results are compatible with the concept that the delivery of endogenous acid from the stomach to the duodenum contributes to secretin release, which in turn may serve as a physiological stimulus for pancreatic bicarbonate secretion.

3774 VITAMIN B_{12} PRODUCTION BY THE GASTROINTESTINAL MICROFLORA OF BABOONS FED EITHER VITAMIN B_{12} DEFICIENT DIET OR A DIET SUPPLEMENTED WITH VITAMIN B_{12}. (Eng.) Uphill, P. F.; Jacob, F.; Lall, P. (Nuffield Inst. Comparative Medicine, Regent's Park, London NW1 4RY, England). *J. Appl. Bacteriol.* 43(3):333-344; 1977.

To determine whether the intestinal flora play a part in vitamin B_{12} nutrition in the baboon, the vitamin B_{12}-producing capacity of microorganisms isolated from baboon feces and gastric contents

was measured using *Lactobacillus leichmannii*. The animals were fed either a diet deficient in or supplemented with (controls) vitamin B_{12}. Samples of gastric and small intestinal contents, obtained at laparotomy from two young vitamin B_{12}-deprived baboons, contained varying quantities of vitamin B_{12}. Many of the organisms isolated from these aspirates produced vitamin B_{12} *in vitro*. The highest levels of vitamin B_{12} were produced by anaerobic organisms. Gastric juice samples from vitamin B_{12}-deprived and control baboons contained similar types of organisms with similar vitamin B_{12}-producing capacity. The vitamin B_{12} content, pH, and total bacterial counts of gastric juice samples aspirated after a 6-hr fast from vitamin B_{12}-deprived baboons were not significantly different from those of the control animals. The pH values of gastric juice samples aspirated 18 hr after feeding, however, were significantly lower ($p<0.001$) than those of 6-hr fasting samples in both groups. The B_{12} content in gastric juice aspirated 18 hr after feeding was significantly greater ($p<0.001$) only in the B_{12}-deprived animals. The mean vitamin B_{12} levels in the total volumes of gastric juice aspirated after each fasting period were similar. The results suggest that gastrointestinal flora are involved in the vitamin B_{12} status of the baboon.

3775 EXPERIMENTAL CLINDAMYCIN-ASSOCIATED COLITIS IN RABBITS: EVIDENCE FOR TOXIN-MEDIATED MUCOSAL DAMAGE. (Eng.) Katz, L.; LaMont, J. T.; Trier, J. S.; Sonnenblick, E. B.; Rothman, S. W.; Broitman, S. A.; *et al.* (Harvard Medical Sch., Boston, MA). *Gastroenterology* 74(2, Part 1): 246-252; 1978.

To study clindamycin colitis under controlled laboratory conditions, severe enterocolitis was produced in rabbits by the p.o. administration of clindamycin in doses comparable to those used in humans. Rabbits given clindamycin (15 mg/kg/day) by nasogastric tube developed diarrhea within 48 to 72 hr that was uniformly fatal by 72 to 96 hr. Controls given comparable doses of ampicillin, tetracycline, neomycin, vancomycin, or saline remained well. At autopsy, the major gross pathological finding was limited to the cecum, which was massively dilated with watery stool. The light microscopic findings in the cecum included necrosis of the surface epithelium and a prominent inflammatory infiltrate in the lamina propria. Fatal clindamycin colitis was prevented in all of 10 tested rabbits by co-administration of vancomycin (30 mg/kg/day); co-administration of penicillin or neomycin prevented the ileocolitis in 3 of 5 and 1 of 5 animals, resp. Cell proliferation, measured by radioautography after [^{3}H]thymidine injection, was significantly increased in cecal mucosa but not in the more distal colonic or small intestinal mucosa during clindamycin administration. Protein synthesis, as determined by incorporation of [^{3}H]leucine into intestinal slices, was significantly increased in both the ileum and cecum after 48 hr of clindamycin administration. Cell-free, sterile extracts of cecal contents of clindamycin-treated animals were injected into ileal loops of untreated rabbits. These fecal extracts produced a severe, hemorrhagic ileitis, although control filtrates from clindamycin-vancomycin-treated animals produced no histological changes. Using selective anaerobic culture media, there was an increase in clostridial species after 48 hr of clindamycin treatment (from 10^5 organisms/g of cecal content in controls to 10^8/g) and a reduction in clindamycin-vancomycin-treated animals (to 10^4 organisms/g). The pathogenesis of clindamycin-associated colitis in rabbits appears to be mediated by a bacterial toxin present in the cecal contents.

3776 ELIMINATION OF SECRETIN [Abstract]. (Eng.) Fahrenkrug, J.; Schaffalitzky de Muckadell, O. B.; Holst, J. J. (Bispebjerg Hosp., Copenhagen, Denmark). *Scand. J. Gastroenterol.* 12(Suppl. 45):19; 1977.

3777 DIFFERENT MECHANISMS OF ACTION OF VASOACTIVE INTESTINAL POLYPEPTIDE (VIP) AND GLUCAGON ON INTESTINAL SECRETION [Letter to Editor]. (Eng.) Mailman, D. (Biology Dept., Univ. Houston, Houston, TX 77004). *Gastroenterology* 73(6):1463-1465; 1977.

3778 CHARACTERIZATION OF SECRETIN-LIKE PEPTIDES FROM TISSUE AND PLASMA EXTRACTS USING IMMUNOAFFINITY CHROMATOGRAPHY [Abstract]. (Eng.) Mason, J. C.; Murphy, R. F.; Buchanan, K. D. (Dept. Biochemistry, Queen's Univ., Belfast, Northern Ireland). *Gut* 18(11):A982-A983; 1977.

3779 SUBCELLULAR DISTRIBUTION OF DI-, TRI-, TETRA- AND PENTA-PEPTIDASE IN HUMAN JEJUNUM [Abstract]. (Eng.) Nicholson, J. A.; Peters, T. J. (Royal Postgraduate Medical Sch., London, England). 18(11):A960-A961; 1977.

3780 ISOLATION AND CHARACTERIZATION OF POLYPEPTIDE HORMONE STORAGE GRANULES FROM HUMAN JEJUNUM [Abstract]. (Eng.) Bryant, M. G.; Bloom, S. R.; Jones, P. E.; Peters, T. J. (Royal Postgraduate Medical Sch., London, England). *Gut* 18(11):A961; 1977.

3781 IDENTIFICATION OF STEM CELLS IN THE RAT AND HUMAN INTESTINAL MUCOSA [Abstract]. (Eng.) Wright, N. A.; Al-Dewachi, H.; Appleton, D. R.; Watson, A. J. (Dept. Pathology, Univ. Newcastle upon Tyne, England). *Gut* 18(11):A967; 1977.

3782 MECHANISM OF ACTION OF PREDNISOLONE ON THE ABSORPTIVE-DIGESTIVE FUNCTIONS OF THE RAT SMALL INTESTINE [Abstract]. (Eng.) Scott, J.; Batt, R. M.; Peters, T. J. (Royal Postgraduate Medical Sch., London, England). *Gut* 18(11):A967; 1977.

SECRETION AND METABOLISM

3783 CONTRIBUTION TO EARLY DEVELOPMENT OF THE SMALL INTESTINE IN THE HUMAN EMBRYO. (Eng.) Pospisilova, V.; Terstianska, G.; Vranakova, V. (Faculty Medicine, Comenius Univ., Bratislava, Czechoslovakia). *Fol. Morphol. (Praha)* 25(4):333-337; 1977.

3784 NUTRITIVE EFFECTS OF FOOD CONSTITUENTS ON THE STRUCTURE AND FUNCTION OF THE INTESTINE. (Eng.) Riecken, E. O.; Menge, H. (Medizinische Universitatsklinik, D-3550 Marburg/Lahn, Marburg, W. Germany). *Acta Hepatogastroenterol. (Stuttg.)* 24(5):389-399; 1977.

3785 SECONDARY EFFECTS OF AGANGLIONOSIS IN THE PIEBALD-LETHAL MOUSE MODEL OF HIRSCHSPRUNG'S DISEASE. (Eng.) Brann, L.; Furtado, D.; Migliazzo, C. V.; Baxendale, J.; Wood, J. D. (Univ. Kansas Medical Center, Kansas City, KS 66103). *J. Lab. Anim. Sci.* 27(6):946-954; 1977.

3786 SECRETION OF MONOQUATERNARY AMMONIUM COMPOUNDS BY GUINEA PIG SMALL INTESTINE IN VIVO. (Eng.) Turnheim, K.; Lauterbach, F. (Univ. Pittsburgh Sch. Medicine, Pittsburgh, PA 15261). *Naunyn Schmiedebergs Arch. Pharmacol.* 299(3):201-205; 1977.

3787 POSSIBLE ROLE OF SUCCUS ENTERICUS IN AMINO ACID HOMEOSTASIS IN THE DOG. (Eng.) Nasset, E. S. (Children's Hosp. Medical Center of Northern California, 51st and Grove St., Oakland, CA 94609). *Digestion* 16(1/2):108-117; 1977.

3788 ASSOCIATION OF SOME ENTEROBACTERIA WITH THE INTESTINAL MUCOSA OF MOUSE IN RELATION TO THEIR PARTITION IN AQUEOUS POLYMER TWO-PHASE SYSTEMS. (Eng.) Perers, L.; Andaker, L.; Edebo, L.; Stendahl, O.; Tagesson, C. (Dept. Medical Microbiology, Univ. Linkoping, S-581 85 Linkoping, Sweden). *Acta Pathol. Microbiol. Scand.* [*B*] 85(5):308-316; 1977.

3789 THE COLONIZATION OF THE HUMAN GUT BY ANTIBIOTIC RESISTANT Escherichia coli FROM CHICKENS. (Eng.) Linton, A. H.; Howe, K.; Bennett, P. M.; Richmond, M. H.; Whiteside, E. J. (Medical Sch., Univ. Bristol, Bristol BS8 1TD, England). *J. Appl. Bacteriol.* 43(3):465-469; 1977.

See also, 3484, 3486, 3541, 3542, 3548, 3559, 3560, 3561, 3567, 3621, 3792, 3794, 3796, 3807, 3810, 3812, 3816, 3819, 3822, 3828, 3835, 3966, 4033, 4262.

GENERAL

3790 THE MECHANISM OF THE CHANGES IN SPLANCHNIC BLOOD FLOW AFTER FEEDING. (Eng.) Benyo, I.; Sandor, J.; Szabo, G. (Semmelweis Univ. Medical Sch., Mezo Imre ut 17, H-1430, Budapest, Hungary). *Res. Exp. Med.* 171(3):255-261; 1977.

The mechanism of the transitory increase in splanchnic blood flow after feeding was studied in dogs. The introduction of hydrolyzed protein solution into the duodenum increased hepatic artery flow by 5.6 ± 3.3% ($p>0.05$) and portal venous flow by 13.6 ± 3.6% ($p<0.05$). Total hepatic blood flow increased 26.4 ± 3.3% ($p<0.001$). The reaction was smaller than after the introduction of 0.1 N HCl (17.9 ± 2.8% increase in hepatic artery flow and 32.3 ± 4.3%, $p<0.001$ increase in portal venous flow). Total hepatic blood flow increased 11.3 ± 2.3% ($p<0.01$-0.05). The introduction of a 30% glucose solution had no effect on splanchnic circulation. Splanchnicotomy combined with celiac ganglion denervation as well as the blockade of the sympathetic alpha receptors abolished the circulatory reaction to intraduodenal acid administration. Both interventions led, however, to a decrease in splanchnic vascular resistance similar to that observed after intraduodenal introduction of acid in normal dogs. It is concluded that the circulatory reaction occurring after the acidification of the duodenal contents after feeding is due to the reduction or abolition of the sympathetic vasomotor tone in the splanchnic vascular bed.

3791 MICROCIRCULATION STUDIES OF THE VILLUS OF THE SMALL INTESTINE OF THE RAT IN VIVO. (Ger.) Knoblauch, M.; Holliger, Ch. (Medizinische Klinik, Kantonsspital, CH-8091 Zurich, Switzerland). *Schweiz. Med. Wochenschr.* 107(40):1391-1399; 1977.

A method of studying the microcirculation in the jejunal villus of the living rat is described. The method used is based on the trans illumination of the exposed mucosa, and it permits the measurement of the velocity of plasma gaps and of the diameter of various vessels. The motility of the gut is overcome by allowing the intestine to adhere to the water immersion lens. The animals were fed *N*-acetyl-L-cysteine to prevent mucus production. A direct arteriovenous connection between the arterioles and the venous system of the villus is postulated. The plasma gap velocity was 1.78 ± 0.62 mm/sec in the arterioles and 0.42 ± 0.08 mm/sec in the capillaries. The measured diameter of the erythrocyte column in the vessels was 9.14 ± 1.89 μm in the central artery, 5.88 ± 1.05 μm in

the proximal third of the arcade arteriole, 6.69 ± 1.04 μm in the middle third, 8.86 ± 1.63 μm in the distal third of the arcade arteriole, 4.56 ± 0.57 μm in the capillaries, and 13.58 ± 2.67 μm in the venules. The method also allows the puncture of villus vessels.

3792 EFFECT OF HYPEROSMOLALITY ON VASCULAR RESISTANCE AND LYMPH FLOW IN THE CAT ILEUM. (Eng.) Levine, S. E.; Granger, D. N.; Brace, R. A.; Taylor, A. E. (Univ. Mississippi Medical Center, Jackson, MS 39216). *Am. J. Physiol.* 234(1):H14-H20; 1978.

To determine the effects of locally infused hyperosmotic solutions of glucose, urea, and sodium chloride on intestinal hemodynamics and tissue hydration, systemic arterial pressure, superior mesenteric arterial and venous pressures, blood flow, lymph flow, and intestinal volume were monitored continuously from an autoperfused loop of cat ileum. The solutes were infused into the superior mesenteric artery at varying rates (0.20-0.80 ml/min) and concentrations (300-1,500 mOsm/kg). Infusion of iso-osmotic solutions of either NaCl or glucose did not significantly alter vascular resistance, tissue volume, or lymph flow. A consistent effect of iso- or hyperosmotic urea infusions was not demonstrated. Hyperosmotic glucose and NaCl infusions both caused marked reductions in vascular resistance; however, the magnitude and time course of the response differed between solutes. Glucose was shown to produce a 2.70% decrease in vascular resistance per 1% increase in plasma osmolality. The resistance responses to hyperosmotic glucose were maintained throughout the infusion period. NaCl infusions produced a 4.87% decrease in vascular resistance for each 1% increase in plasma osmolality. In addition, the NaCl infusions produced a fall in resistance, which waned with time. The osmolality increase induced by the infusion of either solute caused significant reductions in both tissue volume and lymph flow; however, the magnitude of the changes in lymph flow were not correlated to the change in either plasma osmolality or tissue volume. The results suggest that the ileal vasculature may respond more vigorously to osmolality changes than do other regional circulations.

3793 COLONIC RESPONSE TO DIETARY FIBRE FROM CARROT, CABBAGE, APPLE, BRAN, AND GUAR GUM. (Eng.) Cummings, J. H.; Branch, W.; Jenkins, D. J. A.; Southgate, D. A. T.; Houston, H.; James, W. P. T. (Dunn Nutrition Unit, Milton Rd., Cambridge, England). *Lancet* 1(8054):5-8; 1978.

The effects of dietary fiber from different food sources were investigated in 19 healthy men. Approximately 20 g/day of concentrated dietary fiber from either carrot, cabbage, apple, bran, or guar gum was added to the controlled basal diet for 3 weeks. The subjects received no fiber during a second 3-week period. Six subjects took fiber from more than one source. Fecal weight increased by 127% on bran, 69% on cabbage, 59% on carrot, 40% on apple, and 20% on guar gum. These changes in fecal weight were correlated with an increased intake of pentose-containing polysaccharides from the fiber. On the basal diet, there were pronounced individual differences in fecal weight, and from these the response of subjects to the fiber preparations could be predicted. Addition of fiber shortened mean transit time through the gut and significantly diluted an inert marker in the feces. Diet-induced changes in colonic function may explain international differences in the prevalence of colonic disease, while personal variation in the response to dietary fiber may determine individual susceptibility to large bowel disease within a community.

3794 ENDOTOXEMIA AND LARGE INTESTINAL BLOOD FLOW IN SUBHUMAN PRIMATES. (Eng.) Swan, K. G.; Trout, H. H., III; Reynolds, D. G. (New Jersey Medical Sch., 100 Bergen St., Newark, NJ 07103). *Circ. Shock* 4(4):369-377; 1977.

The hemodynamic effects of *Escherichia coli* endotoxin (LD_{80}) were measured in the large intestine of anesthetized Rhesus monkeys to determine whether this organ contributes to the pathogenesis of experimental shock. Inferior mesenteric arterial blood flow (IMF) was measured with an electromagnetic flow meter. Colonic blood flow distribution was measured with radioactive microspheres: Ce, Sr, and Cr were injected into the left heart. Reference blood samples were obtained from a femoral artery. The mean control IMF was 22.9 ± 2.2 ml/min. The aortic pressure was 113 ± 11 mm Hg, and portal venous pressure was 6 ± 1 mm Hg. Arterial blood pH was 7.43 ± 0.02; pO_2 and pCO_2 were 93.4 and 37.1 mm Hg, resp. All parameters were measured at hourly intervals for 4 hr. Neither IMF nor its distribution within the colon changed during the entire observation period. Aortic pressure fell to a low of 60 ± 6 mm Hg ($p<0.02$) at 3 hr; portal venous pressure, pO_2 and pCO_2 were unchanged by endotoxin. Arterial blood pH fell to 7.315 ± 0.020 at 4 hr ($p<0.01$). These observations indicate that the colon is not a "target organ" of endotoxic shock in subhuman primates, despite considerable hypotension and metabolic disturbances subsequent to near lethal endotoxemia.

3795 AN EVALUATION OF THE FUNCTION OF A BIOLOGICAL ESOPHAGEAL TRANSPLANT. (Eng.) Jakobsen, M. K.; Schroder, H.; Mouritzen, C. (Aarhus Kommunehosp., 8000 Aarhus C, Denmark). *Eur. Surg. Res.* 9(2):397-398; 1977.

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3797 TISSUE DISTRIBUTION OF RADIOACTIVITY IN RATS GIVEN TRITIATED ANALOGUES OF HEPATOTOXIC PYRROLIZIDINE ALKALOIDS. (Eng.) Mattocks, A.

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3800 EVIDENCE FOR IMMUNE EXCLUSION AFTER IN VIVO ANTIGEN INFUSION INTO THE GASTROINTESTINAL TRACT [Abstract]. (Eng.) Walker, W. A.; Bloch, K. J. (Massachusetts General Hosp., Boston, MA 02114). *Gastroenterology* 72(5, Part 2):1185; 1977.

3801 THE NEURONAL RELATIONSHIPS BETWEEN THE CELIAC PLEXUS AND THE GASTROINTESTINAL TRACT [Abstract]. (Eng.) Kreulen, D. L.; Szurszewski, J. H. (Mayo Medical Sch., Rochester, MN 55901). *Gastroenterology* 72(5, Part 2):1084; 1977.

3802 MESENTERIC VASODILATION MEDIATED BY BOTH H_1- AND H_2- RECEPTORS TO HISTAMINE [Abstract]. (Eng.) Miller, T.A.; Tepperman, B. L.; Tague, L. L.; Pawlik, W.; Jacobson, E. D. (Univ. Texas Medical Sch., Houston, TX). *Gastroenterology* 72(5, Part 2):1102; 1977.

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3806 EFFECT OF ZINC DEFICIENCY ON SUBMANDIBULAR GLAND IN THE RAT [Abstract]. (Eng.) Iqbal, M.; Meyer, J.; Gerson, S. J. (Dept. Oral Pathology, Univ. Illinois, Chicago, IL). *J. Dent. Res.* 56(B):B112; 1977.

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3813 DIETARY LECTINS: IDENTIFICATION IN FECAL SAMPLES [Abstract]. (Eng.) Vannier, A. M. (Dept. Medicine, Univ. Kentucky, Lexington, KY). *Gastroenterology* 72(5, Part 2):1190; 1977.

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3822 SUBLETHAL DAMAGE IN CELLS OF THE MOUSE GUT AFTER MIXED TREATMENT WITH X RAYS AND FAST NEUTRONS. (Eng.) Hornsey, S.; Andreozzi, U.; Warren, P. R. (Hammersmith Hosp., London W12 OHS, England). *Br. J. Radiol.* 50(595):513-517; 1977.

3823 BIVARIANT EFFECTS OF PENTAGASTRIN ON Ki's OF THE STOMACH AND SMALL AND LARGE INTESTINES OF THE DOG [Abstract]. (Eng.) Dugas, M.; Wechsler, R. L. (Univ. Pittsburgh Medical Sch., Pittsburgh, PA). *Gastroenterology* 72(5, Part 2): 1053; 1977.

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3825 MEASUREMENT OF GASTRIC MUCOSAL BLOOD FLOW IN MAN [Abstract]. (Eng.) Guth, P. H.; Baumann, H.; Grossman, M. I.; Aures, D.; Elashoff, J. (Wadsworth Veterans Admin. Hosp., Los Angeles, CA). *Gastroenterology* 72(5, Part 2):1066; 1977.

3826 EFFECT OF GASTRIC ACID INHIBITION BY METIAMIDE AND VAGOTOMY UPON MUCOSAL MICROCIRCULATION [Abstract]. (Eng.) Goldstone, J.; Patel, M. D.; Way, L. W. (Veterans Admin. Hosp., San Francisco, CA). *Gastroenterology* 72(5, Part 2):1064; 1977.

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3831 STUDIES ON THE BINDING OF BILE ACIDS BY PLASMA PROTEINS [Abstract]. (Eng.) Kakis, G.; Yousef, I. M.; Fisher, M. M. (Dept. Medicine, Univ. Toronto, Toronto, Ontario, Canada). *Gastroenterology* 72(5, Part 2):1178; 1977.

3832 MORPHOLOGIC STUDIES ON THE FATE OF EXPERIMENTAL MALLORY BODIES ('ALCOHOLIC HYALIN') AND THEIR RELATIONSHIP TO CONTRACTILE PROTEINS [Abstract]. (Eng.) Denk, H. (Univ. Vienna Sch. Medicine, Vienna, Austria). *Digestion* 14(5/6):475-476; 1977.

3833 INTRALIPID ASSOCIATED PROTEIN AFTER RAT PLASMA EXPOSURE [Abstract]. (Eng.) Rob-

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3834 EFFECT OF PARTIAL GASTRIC DEVASCULARIZATION ON MUCOSAL BLOOD FLOW AND ACID SECRETION IN CATS [Abstract]. (Eng.) Varhaug, J. E.; Skarstein, A.; Soreide, O.; Svanes, K. (N-5016 Haukeland sykehus, Norway). *Eur. Surg. Res.* 9(Suppl. 1):144; 1977.

3835 RELATIONSHIP BETWEEN DIETARY TRYPTOPHAN (TP) CONTENT AND SEROTONIN (5-HT) LEVELS IN RAT GUT AND WHOLE BLOOD [Abstract]. (Eng.) Colmenares, J. L.; Wurtman, R. J. (Massachusetts Inst. Technology, Cambridge, MA 02139). *Fed. Proc.* 36(3):1020; 1977.

3836 A NEW IN-VIVO SEQUENTIAL TECHNIQUE FOR THE MEASUREMENT OF EFFECTIVE LIVER BLOOD FLOW IN SMALL ANIMALS [Abstract]. (Eng.) Fleming, J. S.; Karran, S. J.; Eagles, C. J.; Ackery, D. (Royal South Hants Hosp., Fanshawe St., Southampton, Hants, England). *Eur. Surg. Res.* 9(Suppl. 1):173-174; 1977.

3837 EFFECTS OF THE PRETREATMENT OF THE DONOR ON THE GVH REACTION INDUCED BY INTRAHEPATIC PEYER'S PATCHES IMPLANTATION IN THE RAT. [Abstract]. (Eng.) Vuitton, D.; Eloy, R.; Grenier, J. F. (U 61 Avenue Moliere, Strasbourg 67200, France). *Eur. Surg. Res.* 9(Suppl. 1):89; 1977.

3838 THE HEPATIC PORTAL OSMORECEPTION AND REGULATION OF WATER BALANCE IN DOGS [Abstract]. (Eng.) Kozlowski, S.; Chwalbińska-Moneta, J. (Medical Res. Center, Polish Acad. Sciences, 1, Jazgarzewska Str., 00-730 Warsaw, Poland). *Eur. Surg. Res.* 9(Suppl. 1):169; 1977.

3839 INHIBITION OF LYMPHOCYTE PROLIFERATION BY MURINE LIVER-SPECIFIC F ANTIGEN. (Eng.) Lane, D. P.; Silver, D. M. (Dept. Zoology, Univ. Coll., London, England). *Transplantation Proc.* 9(1): 1063-1065; 1977.

See also, 3523, 3532, 3549, 3559, 3640, 3641, 3776.

DIAGNOSTIC PROCEDURES

3840 A CELLULOSE ACETATE MEMBRANE PRECIPITIN (CAP) TEST FOR AMOEBIASIS. (Eng.) Stamm, W. P.; Phillips, E. A. (17 Ennismore Gardens, London SW7 1AA, England). *Trans. R. Soc. Trop. Med. Hyg.* 71(6):490-492; 1977.

A simple precipitin test (CAP) using cellulose acetate membrane was devised and compared with the gel diffusion precipitin (GDP) test in 251 sera tested by both methods. The CAP was never negative when the GDP was positive (110 sera). Thirty-four were negative by the GDP but positive by the CAP; in all of these, the patients either had active amebiasis or had a past history of amebiasis. The CAP is technically very simple, and the result is available within 4.5 hr. In addition, the membranes can be impregnated with antigen and stored for several months. The CAP is slightly more sensitive than the GDP and remains positive longer after the patient has been cured; it appears to be equally specific.

3841 CLINICAL EVALUATION OF THE (^{14}C)CHOLYLGLYCINE BREATH TEST. (Eng.) Thaysen, E. H.; Pedersen, L. *In: Bile Acid Metabolism in Health and Disease. Proceedings of the IV Bile Acid Meeting held at the Hilton Hotel, Basel, Switzerland, October 11-12, 1976.* (Baltimore, MD: University Park Press): 263-269; 1977.

The [^{14}C]cholylglycine breath test was compared with the assay combining breath and stool ^{14}C measurements to assess its value in clinical gastroenterology as a measure of increased bile acid deconjugation resulting from either small gut bacterial overgrowth or bile acid malabsorption (excess bile acid loss into the colon). Intestinal bacterial bile acid deconjugation releases glycine whose labeled carboxyl atom is then oxidized to $^{14}CO_2$ and exhaled. Fecal ^{14}C determinations are made after complete combustion of the sample. While the breath test alone cannot discriminate between the small bowel syndrome and the syndrome of bile acid malabsorption, a positive breath test with a negative stool test suggests the former, whereas a positive stool test suggests the latter (the outcome of the breath test being unimportant). Of the 19 patients without gastrointestinal disease and 55 patients with functional diarrhea, only one control had a false-positive breath test and two had positive stool test. Of 68 patients with non-bile acid-related diarrhea, 8 had positive breath tests, and 6 had positive stool tests. Seven of the eight had disorders that could be accompanied by small gut bacterial overgrowth; three of the six also presented circumstantial evidence of involvement of terminal ileum. A positive breath test with a negative stool test was registered in 55 of 86 patients with contaminated small bowel syndrome. Positive stool tests were found in 15 of 16 patients with terminal ileal resections of at least 15 cm and in 31 of 34 patients with terminal ileitis; the breath tests were positive in 8/16 and 14/34, resp. The (^{14}C) cholylglycine breath test is inferior to the complete (^{14}C) cholylglycine assay. The complete (^{14}C)-cholylglycine assay, combining breath and stool ^{14}C measurements, is sensitive and specific, and provides satisfactory discrimination between the contaminated small bowel and bile acid malabsorption syndromes. The assay is superior to any other examination known in detecting terminal ileopathy.

3842 EVALUATION OF THE INDIRECT IMMUNOFLUORESCENCE AND COMPLEMENT FIXATION TESTS FOR THE SERODIAGNOSIS OF SCHISTOSOMIASIS. (Eng.) Wilson, M.; Fried, J.; McQuay, R. M.; Sulzer, A. J. (Center for Disease Control, Atlanta, GA 30333). *Am. J. Trop. Med. Hyg.* 26(6, Part 1):1159-1163; 1977.

Sera from 24 patients with *Schistosoma mansoni* infections, 24 with *S. hematobium*, 24 with *Ascaris* and other intestinal parasites, 22 with *Trichinella spiralis*, 24 with schistosome dermatitis, and 24 healthy subjects were used to compare the sensitivity and specificity of the complement fixation (CF) and the indirect immunofluorescence (IIF) tests for schistosomiasis. Adult antigens were used in both tests. The sensitivities of the IIF and CF tests were 95% and 69%, resp.; the specificities were 98% and 100%, resp. There was no statistical difference between the number of positive reactors among those individuals with no detectable helminth infection and those infected with helminths other than schistosomes. Infected people native to endemic areas had lower reactivity in both tests than did infected U.S. citizens who resided in endemic areas for only a few years. It is concluded that the IIF test with adult antigen is more sensitive than and as specific as the CF test; therefore, the IIF test is the procedure of choice for routine diagnostic serology of schistosomiasis.

3843 USE OF TOLONIUM CHLORIDE IN THE DIAGNOSIS OF MALIGNANT GASTRIC ULCERS. (Eng.) Giler S.; Kadish, U.; Urca, I. (Beilinson Medical Center, Petah Tikva, Israel). *Arch. Surg.* 113(2):136-139; 1978.

Peroral staining with tolonium chloride (toluidine blue) was carried out in 45 patients with suspected gastric ulcer disease in an evaluation of this method for the diagnosis of malignant gastric ulcers. During endoscopy, 19 of 21 malignant ulcers and 1 of 15 benign ulcers were stained. Following surgery, 18 of 21 malignant ulcers found in the surgical specimens were stained. Eleven patients with benign ulcers underwent surgery, and none of these ulcers were found to be stained in the surgical specimens. Normal gastric mucosa and areas of gastritis appeared unchanged. Tolonium chloride staining prior to endoscopy or surgery seems to be helpful in differentiating between minute benign and malignant gastric ulcers.

3844 INHIBITION BY CONCANAVALIN A AS THE BASIS FOR A SPECIFIC ASSAY OF SERUM 5'-NUCLEOTIDASE ACTIVITY. (Eng.) Zygowicz, E. R.; Sunderman, F. W., Jr.; Horak, E.; Dooley, J. F. (Univ.

Connecticut Sch. Medicine, Farmington, CT 06032). *Clin. Chem.* 23(12):2311-2323; 1977.

A new method for assaying serum 5'-nucleotidase activity, which is based on the ability of concanavalin A to inhibit the activity of this enzyme without causing significant inhibition of alkaline phosphatase activity, is described. The method depends upon the difference between the enzymic hydrolysis of adenosine-5'-monophosphate in the presence and absence of concanavalin A. Adenosine released by the 5'-nucleotidase reaction is deaminated by a coupled reaction with adenosine deaminase to liberate inosine and ammonia; the ammonia release was measured colorimetrically. In sera from 40 healthy subjects, 5'-nucleotidase activity averaged 6.4 U/l (± 2.0; range, 3-12). In sera from 100 patients, measurements of 5'-nucleotidase activity by the new assay averaged 8% lower than by a generally accepted method in which phenyl phosphate is used to suppress hydrolysis of adenosine-5'-monophosphate by alkaline phosphatase activity. The clinical validity of the new assay was tested by measuring serum 5'-nucleotidase activities in rats with bile duct ligation and in rats treated with thioacetamide to induce hepatocellular injury. Rats with liver injury had 5'-nucleotidase activities 1.4- to 1.5-fold greater than the nucleotidase activities in controls, and this activity increased to a greater extent in rats with acute biliary obstruction than in rats with acute toxic injury of hepatic parenchymal cells; these findings are consistent with the reports of previous workers who have used other assay methods. The advantages of the new method include: excellent sensitivity and precision; freedom from interference by bilirubin, lipemia, ammonia, and hemoglobin; and low susceptibility to interference by erythrocyte 5'-nucleotidase activity. The method has two disadvantages: it is relatively time-consuming and it is not readily adaptable to automation.

3845 CONTRIBUTION OF ARTERIOGRAPHY TO THE DIAGNOSIS OF LIVER ABSCESS: OBSERVATION OF 20 CASES. (Fre.) Mandoul, M.; Joffre, F.; Carcy, J. B.; Vidal, J. L. (Service Central de Radiologie, CHU Toulouse-Purpan, 31052 Toulouse Cedex, France). *Rev. Med. Toulouse* 12(8):696-709; 1976.

Selective hepatic arteriography was performed in 20 patients with liver abscess by selective catheterization of the celiac trunk and superior mesenteric artery. Inhomogeneous, irregular arteries were found in all 20 cases, "slurred" arteries in 5, avascular tumor syndrome in all 14 cases of presuppurative hepatitis (non-collected abscess), hypervascularization in 14 cases (mostly non-collected abscesses), and micronodular opacification in 8. Hepatic arteriography was especially valuable in the diagnosis of presuppurative hepatitis.

3846 RADIONUCLIDE LIVER SPOTS: INDICATOR OF LIVER DISEASE OR A BLOOD FLOW PHENOMENON. (Eng.) Tetalman, M. A.; Kusumi, R.; Gaughran, G.; Baba, N. (Ohio State Univ. Hosp., 410 West 10th Ave., Columbus, OH 43210). *Am. J. Roentgenol.* 130 (2):291-296; 1978.

The etiology of "hot spots" in liver scans is examined by a review of four cases of superior vena caval obstruction in which there was a spectrum of liver scan findings including correlative venous collateral pathways through the portal system of the liver. It is shown that a finding of "warm spot" or of no spot is also possible. The patient who demonstrated liver hot spot was shown to have incomplete superior vena caval obstruction with numerous collateral channels below the diaphragm. A patient who initially had a hot spot of numerous collateral channels below the diaphragm at the junction between the right and left liver lobes subsequently showed a warm spot superiorly at that point; it was considerably smaller and less active than the hot spot had been. One patient with complete occlusion of the superior vena cava and one with superior vena caval obstruction secondary to carcinoma showed no spot on liver scan. It is suggested that the hot spot is a well-localized abnormal blood flow phenomenon of collateral channels unrelated to any intrinsic liver disease in which the abnormal blood flow presents the surrounding reticuloendothelial cells with a greater portion of colloid to be phagocytized than in the remainder of the liver. Warm spot may be caused by any large area of venous stasis and is probably related to the venous collateral channels in an area of localized adenomata or interstitial fibrosis. Warm spot cannot differentiate between benign and malignant disease but may suggest intrinsic liver pathology.

3847 PERCUTANEOUS TRANSVENOUS APPROACH TO LIVER BIOPSY. (Ger.) Huchzermeyer, H.; Luska, G. (Medizinische Hochschule Hannover, Karl-Wiechert-Allee 9, 3000 Hannover 61, W. Germany). *Innere Med.* 3(3):174-178; 1976.

A new method of liver biopsy, percutaneous transvenous liver biopsy, affording high accuracy is described. The right internal jugular vein, the subclavian vein, or the left internal jugular vein can be used for the biopsy. The biopsy sample is taken by a Ross needle, and the procedure requires local anesthesia. This technique was used in 22 patients with an obstruction syndrome; no major complications were seen. Transvenous liver biopsy is indicated for patients with blood clotting disorders, long-standing obstructive jaundice, or biliary peritonitis, i.e., for patients in whom transperitoneal liver biopsy is contraindicated. Consequently, transvenous biopsy is not an alternative to transperitoneal blind biopsy. Transvenous liver biopsy is contraindicated in purulent cholangitis, liver abscess, cystic liver, echinococcosis, and cardiac arrhythmia. It can be combined with transjugular cholangiography.

3848 COMPLICATION WITH CONTRAST MEDIUM IN ENDOSCOPIC RETROGRADE CHOLANGIOPANCREATICOGRAPHY. (Ger.) Gmelin, E.; Kramann, B.; Weiss,

H. D. (Institut fur Rontgendiagnostik, Techn. Universitat, Ismaninger Str. 22, D-8000 Munich 80, W. Germany). *Munch. Med. Wochenschr.* 119(44):1439-1440; 1977.

In a series of over 2,000 endoscopic retrograde cholangiopancreatographies, allergic shock to the contrast medium (Conray 60) was observed in a 60-yr-old woman. The cholangiopancreatography was performed in a technically correct manner. The patient developed circulatory collapse 10 min after the administration of the contrast medium. Slow recovery was achieved in about 15 min by cortisone treatment and blood substituent infusion. The patient was fully responsive 30 min after the onset of the shock, and she could be discharged in good condition in 24 hr. This observation indicates that patients with known allergy to contrast media should undergo endoscopic retrograde cholangiopancreatography only if other examinations were unsuccessful and diagnostic evaluation is of vital interest.

3849 THE PEPTIDE PABA TEST. (Ger.) Bornschein, W. (II. Med. Klinik, TU Munchen, Ismaningerstrasse 22, 8 Munich 80, W. Germany). *Fortschr. Med.* 95(42):2559-2564; 1977.

The chymotrypsin specificity of the synthetic peptide *N*-benzoyl-L-tyrosyl-*p*-aminobenzoic acid was tested *in vitro* and *in vivo* in 52 subjects, 34 of whom had normal pancreatic function to evaluate the peptide's usefulness as a screening tool for pancreatopathy. Comparative kinetic tests with bovine chymotrypsin and human activated pancreatic juice, as well as clearance tests with *p*-aminobenzoic acid (PABA), demonstrated that this peptide is suitable for an indirect pancreatic function test. In the clinical tests, PABA was administered p.o. (150 mg in 250 ml water), and the PABA level was determined in 9-hr urine. Both with and without pancreatic stimulation by Lundh's test meal, a significant ($p<0.01$) difference was found in the urinary clearance between patients with exocrine pancreatic insufficiency and subjects with normal pancreas. There were 8.8% false-positive and 6.2% false-negative test results. The 6-hr urinary PABA excretion, expressed in percentage of the dose administered, showed good correlations with the 1-hr amount of chymotrypsin in the pancreozymin-cholecystokinin-secretin test and with the fecal chymotrypsin level. These preliminary results indicate that the PABA test is suitable as a screening method in pancreatopathy.

3850 STUDY ON THE EXOCRINE PANCREATIC FUNCTION BY THE ORAL ADMINISTRATION OF N-BENZOYL-L-TYROSYL-PARA-AMINOBENZOIC ACID. (Eng.) Kato, K.; Izumiyama, S.; Sakakura, M.; Hirayama, A.; Ishii, K. (Asahikawa Medical Coll., 3-11, Kaguraoka, Kagura-cho, Asahikawa, Hokkaido, 078-11, Japan). *Gastroenterol. Jpn.* 12(4):289-292; 1977.

The value of *N*-benzoyl-L-tyrosyl-*p*-aminobenzoic acid (Bz-ty-PABA) in the diagnosis of exocrine pancreatic insufficiency was studied in 11 controls, 10 patients with chronic pancreatitis, 7 patients with diabetes mellitus, and 6 patients with liver cirrhosis who received Bz-ty-PABA (500 mg) p.o. The cumulative 6-hr recovery rate of PABA in the urine was significantly lower ($p<0.005$) in patients with chronic pancreatitis (49.1 ± 10.1%), diabetes mellitus (50.4 ± 20.4%), and liver cirrhosis (52.5 ± 13.0%) than in the control group (79.5 ± 12.0%). This test is useful in the diagnosis of pancreatic exocrine insufficiency, especially in chronic pancreatitis.

3851 PURIFICATION, PARTIAL CHARACTERIZATION, AND CLINICAL EVALUATION OF PANCREATIC ONCOFETAL ANTIGEN. (Eng.) Gelder, F. B.; Reese, C. J.; Moossa, A. R.; Hall, T.; Hunter, R. (Dept. Pathology, Univ. Chicago, Box 414, 950 East 59th St., Chicago, IL 60637). *Cancer Res.* 38(2):313-324; 1978.

The purification and partial characterization of a putative pancreatic oncofetal antigen is described. Human fetal tissue (18- to 20-week gestation) and normal and cancerous adult tissues were examined. Pancreatic oncofetal antigen was shown to be a glycoprotein with a molecular weight between 800,000 and 900,000 daltons, which migrated in the α_2- to β-region on electrophoresis. It was found in fetal pancreas and pancreatic cancer tissue but was not found in normal adult pancreas. Highly purified material migrated as a single band during polyacrylamide gel electrophoresis and caused immunized rabbits to produce monospecific antibody without absorption. Pancreatic oncofetal antigen was clearly different from carcinoembryonic antigen, other known tumor-associated antigens, acute-phase reactants, and normal serum proteins. In addition, a quantitative rocket immunoelectrophoresis assay sensitive enough to detect pancreatic oncofetal antigen in the serum of most patients was developed and used to monitor the purification of pancreatic oncofetal antigen and to evaluate its clinical application. Assays for pancreatic oncofetal antigen were carried out on three panels of sera from different sources. Pancreatic oncofetal antigen was found in the sera of most individuals; however, the highest absolute levels and the highest frequency of elevated levels were found in sera of patients with pancreatic carcinoma. Elevated levels of pancreatic oncofetal antigen were also observed in the serum of some patients with lung, stomach, colon, biliary tract, and breast carcinomas, as well as in the serum of some pregnant women and other individuals with certain benign conditions. The spectrum of patients who have elevated levels of pancreatic oncofetal antigen in their serum is quite different from that found with carcinoembryonic antigen or other known tumor markers. Serial assays were performed on the sera of several patients with cancer of the pancreas; the results suggest that measurement of pancreatic oncofetal antigen may be valuable in monitoring the course of pancreatic cancer.

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3854 SPECIAL DIAGNOSTIC TESTS FOR THE EVALUATION OF LIVER AND BILIARY TRACT DISORDERS. (Eng.) Parks, S. N.; Blaisdell, F. W.; Lim, R. C., Jr. (Univ. California, Sch. Medicine, San Francisco, CA). *Surg. Clin. North Am.* 57(2):245-255; 1977.

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See also, 3472, 3493, 3803, 3905, 3906, 3914, 3921, 3922, 3928, 3929, 3941, 3943, 3950, 3951, 3953, 3970, 3978, 3992, 4006, 4019, 4046, 4052, 4059, 4064, 4069, 4076, 4080, 4084, 4088, 4099, 4107, 4109, 4110, 4148, 4155, 4163, 4172, 4182, 4223, 4224, 4244, 4256, 4261, 4267, 4269, 4278.

GASTROINTESTINAL DISEASES

ESOPHAGUS

3905 pH-METRIC INVESTIGATION OF GASTROESOPHAGEAL REFLUX FOLLOWING PENTAGASTRIN ADMINISTRATION. (Ger.) Pflucke, F.; Arendt, R. (Klinik fur Innere Medizin des Bereichs Medizin, Wilhelm-Pieck-Universitat, Ernst-Heydemann-Strasse, DDR-25 Rostock, E. Germany). *Dtsch. Z. Verdau. Stoffwechselkr.* 37(3):117-122; 1977.

Gastroesophageal reflux was measured by pH-metric tests in 36 patients, including 16 with acute reflux symptoms, 6 with mild symptoms, and 14 without symptoms. The tests were conducted in the morning 24 hr after administration of medication and 12 hr after intake of food. The patients swallowed a glass electrode after it had been determined that the pH was <2.0 in their stomachs; pH activities in the distal esophagus were monitored for 1 hr. The patients were then given pentagastrin (6 µg/kg body weight, s.c.) and monitored for 1 hr. Reflux frequency was determined by the number of times the pH level fell below 4; total reflux duration was the total of all separate refluxes. Spontaneous gastroesophageal reflux was observed in six patients during the tests. Of 30 patients without reflux before pentagastrin administration, 19 demonstrated gastroesophageal reflux after pentagastrin; reflux was absent in 11 patients. Pentagastrin appears to stimulate reflux in patients with common reflux problems, but is not effective in patients free of symptoms. Pentagastrin can be diagnostically useful in pH-metric reflux tests.

3906 POSSIBILITIES AND DIAGNOSIS OF EARLY CANCER OF THE STOMACH AND ESOPHAGUS. (Rus.) Vasilenko, V. Kh.; Vodolagin, V. D.; Grebenev, A. L.; Polozhenkova, L. A.; Matyushina, E. D. (I. M. Sechenov First Moscow Medical Inst., Moscow, USSR). *Klin. Med. (Mosk.)* 55(6):21-26; 1977.

3907 STATE OF ELECTROLYTE METABOLISM IN THE POSTOPERATIVE PERIOD IN PATIENTS WITH ESOPHAGEAL AND GASTRIC CARDIA CANCER UNDERGOING PREOPERATIVE TELEGAMMATHERAPY. (Rus.) Shemchuk, A. S.; Ganul, V. L.; Kudria, S. N.; Lisetsky, V. A.; Lialkov, G. S.; Sakun, F. T. (Kiev Scientific Res. Inst. Rentgeno-Radiology and Oncology, Kiev, USSR). *Klin. Khir.* (5):6-10; 1977.

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3910 THE USE OF FOGARTY BALLOON CATHETER FOR DILATATION OF POSTOPERATIVE ESOPHAGEAL STRICTURE. (Jpn.) Kugimiya, T.; Shirabe, J.; Kaku, K.; Kusaba, E.; Hadama, T.; Fukushima, K.; *et al.* (Nagasaki Univ. Sch. Medicine, Nagasaki, Japan). *J. Thorac. Surg.* 30(5):419-422; 1977.

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ESOPHAGUS

3919 POLAROGRAPHY AS A TECHNIQUE FOR DETERMINING THE VIABILITY OF GRAFTS USED IN ESOPHAGOPLASTY. (Rus.) Rubailov, Yu. A.; Kalinin, A. N.; Verkhovodko, P. S. (Volgograd Medical Inst., Volgograd, USSR). *Khirurgiia (Mosk.)* (8):62-66; 1977.

3920 DIAGNOSIS OF DISEASES OF THE ESOPHAGUS. (Ger.) Heitmann, P. (Abteilung fur Innere Medizin II, Krankenstalten Duren, Roonstrasse 30, D-5160 Duren, W. Germany). *Internist (Berlin)* 18(8):409-416; 1977.

3921 ESOPHAGOSCOPY UNDER ANESTHESIA USING DIFFUSION BREATHING. (Rus.) Khylstov, V. N. (Irkutsk Medical Inst. at No. 1 "Znak Pocheta" Oblast Clinical Hosp., Irkutsk, USSR). *Klin. Khir.* (3):52-54; 1977.

3922 ECG TESTS DURING ESOPHAGOGASTRODUODENOSCOPY. (Ger.) Libor, J.; Pocsai, G.; Ivanyi, J. (IIIrd Dept. Internal Medicine, County Hosp., H-5701 Gyula, Hungary). *Z. Gastroenterol.* 15(5):293-299; 1977.

3923 TACTICAL APPROACH TO ESOPHAGEAL RESECTION. (Ger.) Sturzenegger, H. (Mottastrasse 4, Ch-3005 Bern, Switzerland). *Chirurg* 48(7):467-470; 1977.

3924 RELATIVELY RARE, IMPORTANT DISEASES OF THE ESOPHAGUS. (Ger.) Rosch, W. (Medizinische Universitatsklinik, Krankenhausstrasse 12, D-8520 Erlangen, W. Germany). *Internist (Berlin)* 18(8):444-450; 1977.

3925 CARCINOMA OF THE ESOPHAGUS AND CARDIA. (Ger.) Siewert, R.; Lepsien, G.; Peiper, H. J. (Klinik und Poliklinik fur Allgemeinchirurgie, Universitat Gottingen Gosslerstrasse 10, D-3400, Gottingen, W. Germany). *Internist (Berlin)* 18(8): 451-462; 1977.

3926 RESECTION OF THE THORACIC PART OF THE ESOPHAGUS AND ESOPHAGOSTOMA. (Rus.) Kochetov, N. G. (A. V. Lunacharskii Astrakhan' Medical Inst., Astrakhan', USSR). *Klin. Khir.* (3):55-57; 1977.

3927 ESOPHAGEAL DYSFUNCTION. (Ger.) Wienbeck, M. (2. Medizinische Klinik und Poliklinik, Universitat Dusseldorf, Moorenstrasse 5, D-4000 Dusseldorf, W. Germany). *Internist (Berlin)* 18(8): 417-422; 1977.

3928 DIAGNOSITIC POSSIBILITIES OF PROGRAMMED LARGE-FRAME FLUOROGRAPHY IN THE COMPLEX STUDY OF THE ESOPHAGUS IN SYSTEMIC SCLERODERMA. (Rus.) Sokolov, Yu. N.; Savarovsky, A. I.; Kovriga, Yu. P.; Grebneva, L. S.; Filimonov, R. M. (Central Inst. Postgraduate Medical Studies, Moscow, USSR). *Vestn. Rentgenol. Radiol.* (2):10-16; 1977.

See also, 3500, 3507, 3641, 3795, 3872, 3876, 3889, 3891, 3892, 3896, 3902, 3929, 3946, 3953, 3968, 3969, 3970, 3971, 3985, 4160, 4172, 4173, 4174, 4236.

STOMACH

3929 QUANTITATIVE DETERMINATION OF PYLORIC REGURGITATION IN RESPONSE TO INTRADUODENAL BOLUS INJECTION. (Eng.) Rokkjaer, M.; Marqversen, J.; Kraglund, K.; Petersen, J. B. (Kommunehospitalet, Aarhus, Denmark). *Scand. J. Gastroenterol.* 12(7):827-832; 1977.

Duodeno-gastric regurgitation was measured quantitatively in patients using ^{99m}technetium-colloid and external scanning. The median reflux for 32 patients with type I gastric ulcer was 14% (range, 3-100%), which was significantly ($p<0.05$) higher than the median reflux of 4% (range, 1-13%) for 9 controls and the median reflux of 5% (range, 0-16%) for 9 duodenal ulcer patients. There was no significant difference between the reflux in the control and duodenal ulcer groups. When 14 different examinations were evaluated twice, the standard deviation of the differences between the two interpretations was 5.88% with a 95% confidence interval of 4.30-9.27%, which differences were not significant. Thus, the test had fairly good reproducibility. When the reflux test was performed in eight patients before and after antrectomy, a large variance and an absence of a significant difference between the two tests were observed. Although the two tests before and after antrectomy in each of the eight patients differed considerably, a larger reflux was found through the relatively large stoma of a gastro-duodenostomy in only half of the patients after the operation.

3930 EFFECT OF SODIUM BICARBONATE ON ASPIRIN-INDUCED DAMAGE AND POTENTIAL DIFFERENCE CHANGES IN HUMAN GASTRIC MUCOSA. (Eng.) Bowen, B. K.; Krause, W. J.; Ivey, K. J. (Harry S Truman Veterans Admin. Hosp., Columbia, MO 65201). *Br. Med. J.* 2(6094):1052-1055; 1977.

A study was performed to determine whether a small amount of sodium bicarbonate (equivalent to one-

third of a teaspoonful of baking soda) could protect against the microscopic gastric mucosal damage known to be produced by the ingestion of two aspirin tablets in 100 ml of fluid. Sequential gastric biopsy specimens were taken from 15 healthy subjects before, during, and after the intragastric instillation of one of the following isotonic solutions: saline, sodium bicarbonate, 600 mg aspirin suspended in sodium bicarbonate, and aspirin suspended in saline. On a separate day, the same solutions were instilled, but gastric transmucosal potential differences were monitored. Light microscopy and scanning electron microscopy of the biopsy specimens showed occasional mucous degranulation of mucosal surface cells, but no cell damage during instillation of sodium bicarbonate. Light microscopy studies 10 min after instillation of aspirin in saline showed damage in 20% of surface cells, with focal areas of cellular disruption and microscopic erosions, but only 3.4% of cells were damaged after aspirin in bicarbonate, and there were no erosions. Electron microscopy showed a damaged honeycomb appearance of surface epithelium after aspirin in saline and a normal cobblestone appearance after aspirin in bicarbonate. Aspirin dissolved in bicarbonate failed to induce the usual fall in potential difference. These findings indicate that sodium bicarbonate in amounts equivalent to one-third of a teaspoonful of baking soda protects the gastric mucosa against aspirin-induced damage and prevents the usual fall in potential difference after aspirin ingestion.

3931 THE HEATER PROBE: A NEW ENDOSCOPIC METHOD FOR STOPPING MASSIVE GASTROINTESTINAL BLEEDING. (Eng.) Protell, R. L.; Rubin, C. E.; Auth, D. C.; Silverstein, F. E.; Terou, F.; Dennis, M.; *et al.* (Dept. Medicine RG-20, Univ. Washington, Seattle, WA 98195). *Gastroenterology* 74(2, Part 1):257-262; 1978.

A heater probe that can be passed via an endoscope and that can apply pressure and heat simultaneously to a bleeding vessel was developed. A 6.4-mm diameter prototype and a 3.2-mm diameter working model of this device were tested for efficacy in stopping massive bleeding in experimental canine gastric ulcers. Randomized, internally controlled experiments were carried out at laparotomy in heparinized dogs using standard-sized gastric ulcers made and treated via an ample gastrotomy. In acute experiments, the heater probe stopped bleeding from all treated ulcers, whereas all untreated control ulcers continued bleeding. In chronic studies performed at sterile laparotomy, the depth of injury produced by heater probe coagulation was systematically evaluated; dogs were killed at intervals from 1 week to 1 month. No perforations occurred, but histological injury was evident extending from the ulcer base to the serosa in 7 of the 18 ulcers treated with the 6.4-mm probe and in 2 of the 30 ulcers treated with the 3.2-mm probe. In a preliminary endoscopic experiment, the 3.2-mm probe stopped bleeding in 18 of 19 acute experimental ulcers. Histological evidence of injury extending to the serosa occurred in six instances; no perforations occurred. The efficacy in stopping bleeding with this method is satisfactory, but the depth of injury should be reduced before it is applied to humans.

3932 ENDOSCOPIC LASER TREATMENT. III. DEVELOPMENT AND TESTING OF GAS-JET-ASSISTED ARGON LASER WAVEGUIDE IN CONTROL OF BLEEDING EXPERIMENTAL ULCERS. (Eng.) Silverstein, F. E.; Protell, R. L.; Gulacsik, C.; Auth, D. C.; Deltenre, M.; Dennis, M.; *et al.* (Dept. Medicine, RG-20, Univ. Washington, Seattle, WA 98195). *Gastroenterology* 74(2, Part 1):232-239; 1978.

A new argon laser system for the treatment of ulcer bleeding is described, and its efficacy and safety were evaluated in the treatment of experimental canine gastric ulcers. The system consists of a catheter that can be inserted via an endoscopic biopsy channel to deliver a jet of CO_2 coaxially with an argon laser beam. The efficacy of this system in stopping bleeding was tested in two acute experiments at laparotomy in heparinized dogs using a gastric ulcer model. At 7 W of power, the gas jet-assisted laser proved 100% effective in stopping bleeding with an average of three 5-sec exposures, as compared to the same laser without added CO_2, which required an average of eleven 5-sec exposures. Furthermore, the 7-W laser without added CO_2 did not stop all ulcer bleeding. The safety of the CO_2 laser system was tested in a chronic experiment at sterile laparotomy using the same ulcer model. No ulcer treated with the 7-W gas jet-assisted argon laser showed histologic evidence of full thickness injury. When the efficacy of various wattages of the gas jet-assisted laser in stopping bleeding from the ulcer model was tested, the wattages used in this series of experiments and in previous experiments proved to be in the efficacious range. It is concluded that CO_2 added coaxially to a 6- to 7-W argon laser increases the efficacy of coagulation while reducing the depth of injury.

3933 GRADE OF INVASION OF GASTRIC CANCER AT THE TIME OF DIAGNOSIS. (Spa.) Perez Mota, A.; Villalobos Gamez, J. M.; Alberdi Frias, J. M.; Linares Garcia, F.; Moreno Gonzalez, E.; Hidalgo Pascual, M.; *et al.* (Servicio-Escuela de Enfermedades Digestivas del Instituto Nacional de Prevision, Madrid, Spain). *Rev. Esp. Enferm. Apar. Dig.* 51(4):353-362; 1977.

The diagnostic and clinical aspects of gastric cancer are described on the basis of 68 cases. It was possible to diagnose 98% of all cases by the combination of x-raying, biopsy, endoscopy, and cytology. Dyspeptic syndrome was found in 16 patients (average duration 8.8 months), ulcerous syndrome in 52 (average duration 10.3 months), neoplastic syndrome in 60, and macroscopic hemorrhage in 14. The tumor was localized in the antrum in 55% of all cases, in the corpus of the stomach in 25%, and in the magenblase in 12.5%; practically total invasion of the stomach was found in 7%. Adenocarcinoma was diagnosed in 60 cases (highly differentia-

ted tumor in 27 cases, medium differentiated tumor in 12, and tumor of low degree of differentiation in 21). Calix-like metaplasia was seen in 22 of these 60 cases. Signet-ring cell tumor was found in eight cases. Solitary or multiple metastases were found at diagnosis in 58 patients: lymph node metastases accounted for 25.4%; hepatic metastases for 17.6%; pancreatic metastases for 15.6%: vascular metastases for 7.8%; mesenteric metastases for 13.7%; diaphragmatic, peritoneal, colonic, and esophageal metastases for 3.9%; and splenic and retroperitoneal metastases for 1.9%. The tumor invaded the serosa in 6 of the 10 metastasis-free patients, and it was limited to the mucosa and submucosa in the 4 others. The findings indicate the great value of complex screening in high-risk groups.

3934 PRIMARY GASTRIC STUMP CARCINOMA. (Ger.) Wolf, O.; Pannenborg, G.; Voigtsberger, P. (Chirurgische Klinik, Medizinische Akademie, Nordhauser Str. 74, DDR-50 Erfurt, E. Germany). *Zentralbl. Chir.* 102(19):1183-1187; 1977.

The diagnosis and treatment of gastric stump carcinoma are reviewed. Gastric or duodenal resection was performed in 3,476 patients during the 1956-1975 period, among whom 35 patients had carcinoma of the gastric stump. The latent period was 6-38 yr, averaging 21 yr. Epigastric pains, loss of weight, emesis, loss of appetite, nausea, and eructation were the most frequent symptoms. Exploratory laparotomy was performed or endoprosthesis was inserted in 25 cases; radical surgery was possible in only 10 cases. The postoperative mortality was 11/35; 23 patients survived 2-15 months (average, 5.3 months). The 5-yr cure rate was 1/35. The findings indicate that prognosis can be improved only be earlier diagnosis.

3935 STUDY OF HUMORAL IMMUNITY AND GASTRIC FUNCTION IN SUBJECTS WITH VITILIGO. (Ita.) Farini, R.; Veller, C.; Di Mario, F.; Trovo, M.; Borrelli, A.; Meani, A.; *et al.* (Istituto di Clinica Medica I Univ., Padova, Italy). *Minerva Dermatol.* 111(5):271-278; 1976.

Humoral immunity and gastric function were studied in 31 patients with vitiligo. Concomitant diseases included duodenal ulcer in two patients, gastritis in one, and cholelithiasis in two. The subjective complaints included dyspepsia in seven patients, epigastric pains in two, and biliary colic in one. The gastrin level was significantly higher in the patients than in 39 healthy controls (47 ± 26 pg/ml versus 32 ± 20 pg/ml, $p<0.005$). There were no significant differences between the patients and the controls in terms of the basal acid output, maximal acid output, and the peak half-hour acid output, but the values measured in the patients were at the upper limit of the normal range. Hypochlorhydria (maximal acid output below 4 mEq/hr) was found in three patients. Disease associations and biohumoral and immunological alterations were more frequent in patients with hypergastrinemia and/or circulating autoantibodies. There is, however, no clear evidence supporting the immunological pathogenesis of vitiligo.

3936 AGENTS AFFECTING GASTROINTESTINAL FUNCTIONS. (Eng.) Lipinski, C. A.; Hohnke, L. A. (Pfizer Inc., Groton, CT 06340). *Ann. Rep. Med. Chem.* 12:91-100; 1977.

3937 FUNCTIONAL AND MORPHOLOGICAL ASPECTS OF THE STOMACH AND DUODENUM IN CHRONIC RENAL FAILURE [Abstract]. (Eng.) Salera, M.; Biasco, G.; Di Febo, G.; Baldi, F.; Cassan, M.; Miglioli, M.; Barbara, L. (Cattedra di Gastroenterologia dell'Universita, Bologna, Italy). *Rend. Gastroenterol.* 9(1):63-64; 1977.

3938 CORRELATION IN POST-OPERATIVE STOMACHS BETWEEN GROSS APPEARANCE AND HISTOLOGIC FINDINGS [Abstract]. (Eng.) Tarder, G.; Burbige, E. J.; French, S. W.; Belber, J. P. (Veterans Admin. Hosp., Martinez, CA). *Gastroenterology* 72(5, Part 2):1167; 1977.

3939 NITROGEN-SPARING EFFECT OF DIFFERENT FEED REGIMES IN PATIENTS AFTER OPERATION. (Eng.) Rowlands, B. J.; Giddings, A. E. B.; Johnston, A. O. B.; Hindmarsh, J. T.; Clark, R. G. (Northern General Hosp., Sheffield, Yorkshire, England). *Br. J. Anesth.* 49(8):781-787; 1977.

3940 ENDOSCOPIC EXAMINATION OF THE OPERATED STOMACH [Abstract]. (Eng.) Geile, D.; Ultsch, B. (Surgical Clinic of the Clinicum re. d. Isar, Technical Univ., Munich, W. Germany). *Endoscopy* 9(2):115; 1977.

3941 TUBELESS HYPOTONIC EXAMINATION OF THE AFFERENT LOOP OF THE BILLROTH II STOMACH. (Eng.) Op Den Orth, J. O. (St. Elisabeth's Groote Gasthuis, Boerhaavelaan 22, Haarlem, Netherlands). *Gastrointest. Radiol.* 2(1):1-5; 1977.

3942 TREATMENT OF STENOTIC ANASTOMOSES AFTER GASTRECTOMY BY ENDOSCOPY [Abstract]. (Eng.) Weiss, H.; Hold, H.; Neumayr, A.; Schuller, J. (First Dept. Medicine, KA Rudolfstiftung, Vienna, Austria). *Endoscopy* 9(2):113-114; 1977.

3943 THE ANASTOMOSIS AFTER TOTAL GASTRECTOMY--A DOMAIN OF ENDOSCOPY [Abstract]? (Eng.) Ultsch, B.; Geile, D. (Surgical Clinic, Technical Univ., Munich, W. Germany). *Endoscopy* 9(2):116; 1977.

3944 BONE COMPOSITION AND VITAMIN D AFTER POLYA GASTRECTOMY. (Eng.) Tougaard, L.;

Rickers, H.; Rodbro, P.; Thaysen, E. H.; Christensen, M. S.; Lund, B.; Sorensen, O. H. (Alborg General Hosp., Alborg, Denmark). *Acta Med. Scand.* 202(1/2):47-50; 1977.

3945 VITAMIN B12 DEFICIENCY FOLLOWING POLYA GASTRECTOMY. A LONG-TERM FOLLOW-UP. (Eng.) Buxton, R. A.; Collins, C. D.; Phillips, M. J. (Princess Margaret Hosp., Okus Rd., Swindon, Wilts SN1 4JU, England). *Br. J. Clin. Pract.* 31(6):69-72; 1977.

3946 FUNDOPLICATION FOR HYPOTENSIVE LOWER ESOPHAGEAL SPHINCTER AFTER GASTRECTOMY. (Eng.) Ellis, F. H., Jr. (Lahey Clinic Foundation, Boston, MA). *Surg. Gynecol Obstet.* 145(3):430-431; 1977.

3947 EARLY AND LATE RADIOLOGICAL FEATURES OF DAMAGE TO THE STOMACH CAUSED BY ACID INGESTION. (Eng.) Kleinhaus, U.; Rosenberger, A.; Adler, O. (Rambam Univ. Hosp., Haifa, Israel). *Radiol. Clin. (Basel)* 46(1):26-37; 1977.

3948 CIMETIDINE PROTECTION FROM ASPIRIN-INDUCED HUMAN GASTRIC MUCOSAL DAMAGE [Abstract]. (Eng.) Ivey, K. J.; Mackercher, P. A.; Baskin, W. N.; Krause, W.; Jeffrey, G. E. (Dept. Medicine, Univ. Missouri, Columbia, MO). *Rend. Gastroenterol.* 9(1):79; 1977.

3949 COMPARISON OF EFFECT OF ASPIRIN ON GASTRIC MUCOSA OF CHRONIC RHEUMATOID ARTHRITICS WITH NORMAL SUBJECTS [Abstract]. (Eng.) MacKercher, P. A.; Ivey, K. J.; Baskin, W. N.; Krause, W. J.; Tatum, W.; Morris, A. (Veterans Admin. Hosp., Columbia, MO). *Gastroenterology* 72(5, Part 2):1092; 1977.

3950 ANALYSIS OF THE DIAGNOSTIC ACCURACY OF RADIOLOGY, ENDOSCOPY AND BIOPSY IN GASTRIC CANCER [Abstract]. (Eng.) Stern, H.; Medline, A. (Toronto Western Hosp., Toronto, Ontario, Canada). *Gastroenterology* 72(5, Part 2):1179; 1977.

3951 THE ACCURACY OF THE BARIUM MEAL IN THE DIAGNOSIS OF CARCINOMA OF THE STOMACH. (Eng.) Allan, S.; Coates, R. H. (Christchurch Hosp., New Zealand). *Aust. Radiol.* 20(3):236-238; 1977.

3952 MULTIPLE "SPOT" BIOPSY TECHNIQUE FOR INFILTRATIVE GASTRIC CARCINOMA. (Eng.) Altman, A. R.; Finkel, S.; Waye, J. D. (Mount Sinai Sch. Medicine, City Univ. New York, New York, NY 10029). *Mt. Sinai J. Med.* 44(4):570-573; 1977.

3953 ENDOSCOPIC FOLLOW-UP STUDIES IN RESECTED PATIENTS WITH CARCINOMA OF THE ESOPHAGUS AND STOMACH [Abstract]. (Eng.) Groitl, H.; Vollmar, D.; Tonak, J. (Univ. Hosp. Erlangen, Erlangen, W. Germany). *Endoscopy* 9(2):115; 1977.

3954 HISTOGENETIC TYPES AND SIZE OF POLYPOID LESIONS IN THE STOMACH, WITH SPECIAL REFERENCE TO CANCEROUS CHANGE. (Eng.) Kozuka, S.; Masamoto, K.; Suzuki, S.; Kubota, K.; Yokoyama, Y. (Nagoya Univ. Sch. Medicine, 65 Tsurumai-cho, Showa-ku, Nagoya 466, Japan). *Gann* 68(3):267-274; 1977.

3955 STAGE I INTRAMUCOSAL GASTRIC CANCER [Abstract]. (Eng.) Deutsch, E.; Apffel, C. A.; Walker, J.; Healey, B. (Carney Hosp., Boston, MA). *Gastroenterology* 72(5, Part 2):1157; 1977.

3956 GASTRIC CARCINOMA I. THE REPRODUCIBILITY OF A HISTOGENETIC CLASSIFICATION PROPOSED BY MASSON, REMBER AND MULLIGAN. (Eng.) Teglbjaerg, P. S.; Vetner, M. (Odense Univ. Hosp., 5000 Odense, Denmark). *Acta Pathol. Microbiol. Scand.* [A] 85(4):519-527; 1977.

3957 GASTRIC CARCINOMA 2. AN ANALYSIS OF MORPHOLOGICAL AND PROGNOSTIC PARAMETERS CORRELATED TO THE CLASSIFICATION PROPOSED BY MASSON, REMBER AND MULLIGAN. (Eng.) Teglbjaerg, P. S.; Vetner, M. (Odense Hosp., 5000 Odense, Denmark). *Acta Pathol. Microbiol. Scand.* [A] 85(4):528-534; 1977.

3958 GASTRIC CANCER FOLLOWING MEDICAL OR SURGICAL TREATMENT OF PEPTIC ULCER [Abstract]. (Eng.) Papachristou, D.; Fortner, J. G. (Memorial Sloan-Kettering Cancer Center, New York, NY 10021). *Gastroenterology* 72(5, Part 2):1163; 1977.

3959 ADENOCARCINOMA OF THE PROXIMAL THIRD OF THE STOMACH. PITFALLS IN SURGICAL MANAGEMENT. (Eng.) Alfonso, A.; Rosen, P.; Guerra, O.; Fortner, J. (Downstate Medical Center, 450 Clarkson Ave., Brooklyn, NY 11203). *Am. J. Surg.* 134(3):326-330; 1977.

3960 BENIGN LESIONS OF THE STOMACH MIMICKING CARCINOMA. (Eng.) Herzog, R. J.; Hanelin, L. G.; Margulis, A. R. (Univ. California Sch. Medicine, San Francisco, CA 94143). *JAMA* 238(7): 623-626; 1977.

3961 LEIOMYOMAS OF THE STOMACH. (Eng.) Singh, R. P.; Zamora, I.; Lee, S. T. J.; Laquer, W. A. (Beckley Appalachian Regional Hosp., P.O. Box 1149 Beckley, WV 25801). *Int. Surg.* 62(6/7):352-354; 1977.

3962 METASTATIC PATTERN AND LENGTH OF SURVIVAL IN PATIENTS WITH LIVER METASTASES FROM GASTRIC CANCER. (Eng.) Okazaki, N.; Seto, T.; Kanda, Y.; Yoshino, M.; Yoshida, T. (Natl. Cancer Center Hosp., Tokyo, Japan). *Jpn. J. Clin. Oncol.* 7(1):5-8; 1977.

3963 RESULTS OF SURGERY FOR GASTRIC CANCER AND EFFECT OF ADJUVANT MITOMYCIN C ON CANCER RECURRENCE. (Eng.) Imanaga, H.; Nakazato, H. (Aichi Cancer Center Hosp., 81-1159, Kanokoden, Tashiro-cho, Chikusa-ku, Nagoya 464, Japan). *World J. Surg.* 1(2):213-221; 1977.

3964 SERUM GASTRIN RESPONSES TO STIMULATION TESTS IN PATIENTS WITH GASTRINOMA [Abstract]. (Eng.) Vezzadini, P.; Bonora, G.; Tomassetti, P.; Cavicchi, A.; Cipollini, F.; Sternini, C.; *et al.* (Istituto di Clinica Medica dell'Universita, Bologna, Italy). *Rend. Gastroenterol.* 9(1):62; 1977.

See also, 3550, 3558, 3562, 3571, 3575, 3576, 3581, 3582, 3593, 3594, 3595, 3596, 3766, 3798, 3799, 3827, 3843, 3864, 3868, 3869, 3872, 3876, 3879, 3889, 3892, 3896, 3904, 3905, 3906, 3907, 3912, 3922, 3925, 3947, 3965, 3968, 3969, 3970, 3971, 3973, 3981, 3982, 3985, 3987, 3988, 3989, 4234, 4236, 4245, 4246, 4259.

STOMACH

Peptic Ulcers

3965 CHRONIC GASTRITIS AND PEPTIC ULCER. (Eng.) Zaterka, S.; Vieira, F. E.; Pfuhl Neves, D.; da Silva, E. P.; Carneiro Leao, G.; Bettarello, A. (Medical Sch., Univ. Sao Paulo, Rua Estados Unidos, 1470, Sao Paulo, Brazil). *Acta Hepatogastroenterol. (Stuttg.)* 24(5):381-385; 1977.

The incidence of gastritis was determined in 51 patients with duodenal ulcer and 46 with gastric ulcer, and the relationship between gastritis and the location of the ulcer was studied. Six biopsies (3 from the antrum and 3 from the body) were obtained from each patient under direct vision at endoscopy. Chronic gastritis was classified according to the grade of inflammation (slight, moderate, or intense) and its location (antritis or pangastritis). In gastric ulcer, the relationship between frequency of chronic gastritis and the site of the ulcer (antrapyloric, at the angulus, body of the stomach) was also established. Antritis was as frequently observed in duodenal ulcer (94%) as in gastric patients (96%), but severe inflammation of the antrum was higher in gastric ulcer (43%) than in duodenal ulcer (17%). Chronic gastritis of the gastric body was always accompanied by antritis in both gastric and duodenal ulcer; gastritis was observed in 63% of the former group and 37% of the latter. Severe inflammation of the glandular portion of the stomach occurred in only one patient with duodenal ulcer (2%) and in seven with gastric ulcer (15%). No relationship between the site of gastric ulcer and the frequency of chronic gastritis was observed.

3966 EFFECT OF CIMETIDINE ON BILIARY AND PANCREATIC FUNCTION IN MAN [Abstract]. (Eng.) Maudgal, D. P.; Lawrence, D.; Bird, R.; Sanderson, P.; Northfield, T. C. (St. James' Hosp., London, England). *Gut* 18(11):A981; 1977.

3967 ABNORMAL GASTRIC EMPTYING RESPONSE TO PENTAGASTRIN IN DUODENAL ULCER [Abstract]. (Eng.) Dubois, A.; Myers, L.; Castell, D. O. (Uniformed Services Univ. Health Sciences, Bethesda, MD). *Clin. Res.* 25(4):571A; 1977.

3968 EFFECT OF EXTRINSIC DENERVATION OF THE LOWER END OF THE OESOPHAGUS ON RESTING AND CHOLINERGIC-STIMULATED GASTRO-OESOPHAGEAL SPHINCTER PRESSURE [Abstract]. (Eng.) Csendes, A.; Oster, M.; Moller, J.; Brandsborg, O.; Brandsborg, M.; Amdrup, E. (Kommunehospitalet, Univ. Arhus, Arhus, Denmark). *Gut* 18(11):A974; 1977.

3969 GASTRO-OESOPHAGEAL REFLUX IN DUODENAL ULCER AND AFTER PARIETAL CELL VAGOTOMY (PCV), SELECTIVE GASTRIC VAGOTOMY PLUS DRAINAGE (SGV + D) AND SELECTIVE GASTRIC VAGOTOMY PLUS ANTRECTOMY (SGV + A) [Abstract]. (Eng.) Oster, M.; Csendes, A.; Brandsborg, O.; Brandsborg, M.; Amdrup, E. (Kommunehospitalet, Univ. Arhus, Arhus, Denmark). *Gut* 18(11):A974; 1977.

3970 EARLY ENDOSCOPY AND OUTCOME OF THE PATIENT WITH UPPER GASTROINTESTINAL BLEEDING [Letter to Editor]. (Eng.) Rohde, H.; Troidl, H.; Fischer, M.; Vestweber, K. H.; Lorenz, W. (Dept. Surgery, Philipps Univ., Robert-Koch-Strasse 8, 355 Marburg, W. Germany). *Gastroenterology* 73(5): 1188-1189; 1977.

3971 ACUTE UPPER GASTROINTESTINAL HEMORRHAGE [Abstract]. (Eng.) Farthmann, E. H. (Univ. Hosp. Eppendorf, 2000 Hamburg 20, W. Germany). *Endoscopy* 9(3):185; 1977.

3972 DIBUCAINE NUMBER (DN) IN DUODENAL ULCER [Letter to Editor]. (Eng.) Ahmad, K.; Anwar, N.; Sattar, A. (Inst. Postgraduate Medicine and Res., Shahbag, Dacca, Bangladesh). *Am. J. Dig. Dis.* 22(10):933; 1977.

3973 DUODENAL AND GASTRIC ULCER. SURVEY OF OBSERVATIONS AND RESULTS IN 2,095 PATIENTS. (Ger.) Hammann, J.; Fux, D.; Haus, J.; Blindow, B. (Chirurgische Klinik der Stadtischen Krankenanstalten, 7500 Karlsruhe, W. Germany). *Therapiewoche* 26(37): 5687-5704; 1976.

3974 SIMULTANEOUS X-RAY EXAMINATION AND DEEP PSYCHOLOGICAL INTERVIEW OF PATIENTS WITH DUODENAL ULCER. (Ger.) Zander, W. (Psychosomatische Beratungsstelle der Medizinischen Poliklinik, Pettenkoferstrasse 8a, 8000 Munchen 2, W. Germany). *Therapiewoche* 26(36):5516-5517; 1976.

3975 CHANGES IN AMINO ACID COMPOSITION OF THE BLOOD SERUM IN PATIENTS WITH DUODENAL ULCER. (Rus.) Degtyareva, I. I.; Solodova, E. V. (Kiev Medical Inst., Kiev, USSR). *Klin. Med.* 55(4): 47-52; 1977.

3976 RUSSELL BODIES IN THE DUODENAL MUCOSA IN DUODENAL ULCER. (Rus.) Survillo, O. N.; Bobrovskikh, M. P. (Voronezh Medical Inst., Voronezh, USSR). *Arkh. Patol.* 39(3):16-22; 1977.

3977 CLINICAL EXPERIENCE WITH GASTROPULGIT, A NEW COLLOIDAL SILICATE, AS A CONTACT ANTACID. (Ger.) Gobel, D. (Medizinische Abteilung, Paracelsus Klinik, 7500 Karlsruhe 41, W. Germany). *Therapiewoche* 26(36):5577-5580; 1976.

3978 TRIAL OF HISTALOG® IN PATIENTS WITH PEPTIC ULCER AND IN OPERATED PATIENTS: COMPARISON OF THE CONTROL AND GASTRECTOMIZED PATIENTS WITHOUT ULCER. (Por.) Zaterka, S.; Lima, F. L. A.; Bettarello, A.; Neves, D. P. (Clinica de Gastroenterologia, Depart. de Clin. Medica da FMUSP., Sao Paulo, Brazil). *Rev. Hosp. Clin. Fac. Med. Sao Paulo* 32(1):63-66; 1977.

3979 MAZUR-A CAPSULES IN THE TREATMENT OF PEPTIC ULCER. PRELIMINARY REPORT. (Ger.) Heschl, R. (Medizinische Universitatsklinik, Auenbruggerplatz 15, A-8036 Graz, Austria). *Wien. Med. Wochenschr.* 127(11):346-348; 1977.

3980 HYPOTHERMIC TREATMENT OF EXACERBATED ULCER WITH COLD MILK. PRELIMINARY REPORT. (Ger.) Bsteh, O. (Liechtensteinstrasse 31, A-2130 Mistelbach, Austria). *Wien. Med. Wochenschr.* 127(13):422-424; 1977.

3981 EXPERIENCE WITH SURGICAL TREATMENT OF PATIENTS WITH COMPLICATED FORMS OF PEPTIC ULCER. (Rus.) Savchenko, A. A.; Salkov, G. M. (Zhitomir Oblast Hosp., Zhitomir, USSR). *Klin. Khir.* (3):57-59; 1977.

3982 CAUSES OF LATE ORGANIC COMPLICATIONS FOLLOWING GASTRIC RESECTION FOR PEPTIC ULCER. (Rus.) Sazonov, S. P. (Tiumen Medical Inst. Tiumen, USSR). *Klin. Khir.* (3):39-43; 1977.

3983 EXPERIENCE WITH SURGICAL TREATMENT OF PATIENTS WITH RECURRENCES OF PEPTIC ULCER OF THE ANASTOMOSIS. (Rus.) Spivak, V. P.; Bondarenko, P. G. (Dnepropetrovsk Scientific Res. Inst. Gastroenterology, Dnepropetrovsk, USSR). *Klin. Khir.* (3):37-39; 1977.

3984 BILATERAL TRUNCAL VAGOTOMY WITH PYLOROPLASTY IN THE TREATMENT OF DUODENAL ULCER. (Ita.) Taschieri, A. M.; Percio, F. M.; Contessini Avesani, E.; Mezzetti, M.; Scortecci, V. (Istituto di Patologia Chirurgica 2a, Universita delgi Studi di Milano, Milano, Italy). *Arch. Ital. Chir.* 100(2): 167-171; 1977.

3985 MANOMETRIC INVESTIGATIONS ON THE INFLUENCE OF SELECTIVE PROXIMAL VAGOTOMY ON THE LOWER ESOPHAGEAL SPHINCTER. (Ger.) Witte, J.; Zumtobel, V.; Rattenhuber, U.; Londong, W.; Feifel, G.; Lang, G.; *et al.* (Chirurgische Klinik der Universitat Munchen, Nussbaumstrasse 20, D-8000 Munchen 2, W. Germany). *Z. Gastroenterol.* 15(4):231-236; 1977.

3986 SECRETION OF FREE HYDROCHLORIC ACID AFTER ORGAN-PRESERVING OPERATIONS. (Rus.) Perkin, E. M.; D'yachuk, V. D. (Novokuznetsk Inst. Postgraduate Medical Studies, Novokuznetsk, USSR). *Vestn. Khir.* 118(3):34-38; 1977.

3987 25-HYDROXYVITAMIN-D_3 SERUM LEVEL FOLLOWING BILLROTH II GASTRIC RESECTION IN PATIENTS WITH GASTRIC OR DUODENAL ULCER. (Ger.) Sonnenberg, A.; Sonnenberg, G. E.; v. Lillienfeld-Toal, H.; Strohmeyer, G. (Stadtspital Triemli, Birmensdorfer Strasse 497, CH-8063 Zurich, Switzerland). *Z. Gastroenterol.* 15(4):237-239; 1977.

3988 PROTEIN METABOLISM FOLLOWING GASTRIC RESECTION. (Ger.) Beno, I.; Chorvathova, V.; Cerven, J. (Ernahrungsforschungsinstitut, Namestie 4, aprila 7, 88030 Bratislava, Czechoslovakia). *Dtsch. Z. Verdau. Stoffwechselkr.* 36(5/6):263-267; 1976.

STOMACH

3989 EFFECT OF ELECTROSTIMULATION OF THE GASTRO-INTESTINAL TRACT ON HEMOSTATIC CHANGES FOLLOWING SURGERY FOR ULCER DISEASE. (Rus.) Chetverikova, V. N.; Shtuchnaya, L. P.; Starodubtseva, I. S.; Titarenko, A. A. (Dnepropetrovsk Medical Inst., Dnepropetrovsk, USSR). *Klin. Khir.* (3):23-28; 1977.

See also, 3481, 3553, 3563, 3825, 3881, 3892, 3896, 3929, 3936, 3937, 3940, 3943, 3958, 4234.

SMALL INTESTINE

3990 FACTORS INFLUENCING SMALL BOWEL CHANGES IN DERMATITIS HERPETIFORMIS. (Eng.) Roberts-Thomson, I. C.; Stevens, D. P.; Michel, B.; Braun, W. E.; Morris, P. J.; Wall, A. J.; *et al.* (Royal Melbourne Hosp., Victoria 3050, Australia). *Aust. N.Z. J. Med.* 7(4):356-362; 1977.

Factors influencing small bowel morphology in dermatitis herpetiformis (DH) were investigated by comparing 9 patients with DH and normal small bowel biopsies with 18 patients with DH and abnormal small bowel biopsies. The mean age of the patients with morphological changes in small bowel (38 yr) was significantly lower ($p<0.001$) than that of the patients with normal bowel mucosa (60 yr). Histocompatibility locus antigen (HLA) typing confirmed the high frequency of HLA-B8 in DH (64%), but HLA-B8 was unrelated to the presence or severity of small bowel lesions. Four patients had diarrhea with progressive weight loss or abdominal cramps subsequently responsive to gluten withdrawal. In this subgroup, serum IgG and IgM levels were significantly lower than in patients with normal small bowel mucosa. Small bowel involvement appeared to be independent of the duration and severity of skin disease, and the deposition of immunoglobulin and complement (C3) in the dermal papillae of skin adjacent to skin lesions. The relation between age and small bowel morphology in DH has not been noted previously.

3991 SYMPTOMATIC INTESTINAL DISACCHARIDASE DEFICIENCY IN ALCOHOLICS. (Eng.) Perlow, W.; Baraona, E.; Lieber, C. S. (Veterans Admin. Hosp., 130 W. Kingsbridge Rd., Bronx, NY 10468). *Gastroenterology* 72(4, Part 1):680-684; 1977.

3992 ARTERIOGRAPHY OF A BLEEDING DUODENAL DIVERTICULUM. (Eng.) Ghahremani, G. G.; Hietala, S. O. (Evanston Hosp., 2650 Ridge Ave., Evanston, IL 60201). *Am. J. Dig. Dis.* 22(5):445-448; 1977.

3993 PERFORATED PERIVATERIAN DUODENAL DIVERTICULITIS. (Eng.) Widdershoven, G. M. J. (Elisabeth Ziekenhuis, Sluiskil, Netherlands). *Arch. Chir. Neerl.* 29(2):153-157; 1977.

3994 PREOPERATIVE RADIOGRAPHIC DIAGNOSIS OF A SPIGELIAN HERNIA CONTAINING LARGE AND SMALL BOWEL. (Eng.) Hunter, T. B.; Freundlich, I. M.; Zukoski, C. F. (Univ. Arizona Medical Center, Tucson, AZ 85724). *Gastrointest. Radiol.* 1(4):379-381; 1977.

3995 TERMINAL ILEITIS: Yersinia enterocolitica ISOLATED FROM FAECES. (Eng.) Doraiswamy, N. V.; Currie, A. B. M.; Gray, J.; Lynton-Moll, C.; Mair, N. S. (East Birmingham Hosp., Birmingham B9 5ST, England). *Br. Med. J.* 2(6078):23; 1977.

3996 ACUTE TERMINAL ILEITIS AND Yersinia enterocolitica INFECTION [Abstract]. (Eng.) Kato, Y.; Hattori, T. (Nagoya Univ. Sch. Medicine, Nagoya, Japan). *Gastroenterol. Jpn.* 12(1):95-96; 1977.

3997 FATAL HEPATIC FAILURE AFTER JEJUNOILEAL BYPASS. CLINICAL AND LABORATORY EVIDENCE OF PROGNOSTIC SIGNIFICANCE. (Eng.) Weismann, R. E.; Johnson, R. E. (Hitchcock Clinic, Hanover, NH 03755). *Am. J. Surg.* 134(2):253-258; 1977.

3998 PROGRESSIVE RENAL FAILURE WITH HYPEROXALURIA: A NEW COMPLICATION OF JEJUNOILEAL BYPASS [Abstract]. (Eng.) Earnest, D.; Campbell, J.; Hunt, T. K.; Naughton, J. (Univ. California Sch. Medicine, San Francisco, CA). *Gastroenterology* 72(5, Part 2):1054; 1977.

3999 PREGNANCY AFTER JEJUNOILEAL SHUNT. (Eng.) Stenning, H.; Campbell, R.; Brake, I.; Anderson, J. (Women's Hosp., Crown St., Surry Hills, New South Wales 2010, Australia). *Med. J. Aust.* 1(21):781-782; 1977.

4000 PLEXIFORM NEUROFIBROMATOSIS OF THE ILEUM IN AN INFANT. (Eng.) Takahashi, M.; Katsumata, K.; Yokoyama, J.; Yokoyama, S.; Mikata, A. (Keio Univ. Sch. Medicine, Shinanomachi-35, Shinjuku, Tokyo, Japan). *J. Pediatr. Surg.* 12(4):571-574; 1977.

4001 NONTRAUMATIC PERFORATIONS OF THE SMALL INTESTINE. (Eng.) Huttunen, R.; Kairaluoma, M. I.; Mokka, R. E.; Larmi, T. K. I. (Dept. Surgery, Univ. Oulu, 90220 Oulu 22, Finland). *Surgery* 81(2):184-188; 1977.

4002 OSTEOMALACIA IN THE STAGNANT LOOP SYNDROME. (Eng.) Schjonsby, H. (Medical Dept. A, Univ. Clinic, Bergen, Norway). *Acta Med. Scand.* (Suppl. 603):39-41; 1977.

See also, 3763, 3780, 3798, 3814, 3816, 3821, 3841, 3852, 3859, 3860, 3866, 3889, 3892, 3896, 3922, 3937, 3945, 3970, 3973, 3981, 4009, 4013, 4045, 4049, 4235, 4236, 4238, 4240, 4243, 4257, 4259, 4260, 4262, 4264, 4275, 4279, 4281.

SMALL INTESTINE

Malabsorption

4003 ASSOCIATION OF PRECIPITINS AND COELIAC DISEASE. (Eng.) Kavai, M.; Csorba, S.; Szabolcs, M.; Jezerniczky, J.; Fesus, L.; Szabo, B. (Univ. Medical Sch., 4004 Debrecen, Hungary). *Acta Allergol. (Kbh.)* 32(6):395-405; 1977.

The blood antibody types were studied in the sera of 28 celiac patients and of controls in an effort to understand the induced reaction resulting in gluten intolerance in this disease. Four fractions (A, B, C, and D) were isolated from the cold (2-4 C) aqueous extract of wheat flour by Sephadex G-75 column fractionation. Fraction A (molecular weight, 36,000-61,000 daltons) reacted as an antigen with the sera of celiac patients. Its molecular weight and amino acid composition (particularly, the high quantities of glutamic acid and proline) were similar to those of gliadin. IgE exceeded the normal value only in 3 patients (601-1,000 IU/ml), whereas 14 patients had 200-600 IU IgE/ml and 11 patients had 100-200 IU IgE/ml. The heat-inactivated sera of the patients formed a precipitate with the homologous antigen in higher dilutions than did the sera from controls. On the basis of *in vitro* rat mast cell sensitizing capacity of the patients' sera, specific antigliadin IgE was only found in one out of the seven patients tested, and this was a patient with elevated IgE level. Sera containing high quantities of antibody (as shown by precipitation and passive hemagglutination assays) were compared before and after absorption by anti-IgG and anti-IgA for their ability to form precipitates with antigen (gliadin) and anti-IgG in immunodiffusion assays. Prior absorption by anti-IgG was more effective than prior absorption by anti-IgA in reducing the reaction of the sera with gliadin. The results are consistent with the conclusion that antibody produced against wheat-derived protein circulating in serum belongs mainly to the IgG class.

4004 IMMUNOLOGICAL ABNORMALITIES IN COELIAC DISEASE AND THEIR RESPONSE TO DIETARY RESTRICTION. I. SERUM IMMUNOGLOBULINS, ANTIBODIES AND COMPLEMENT. (Eng.) Ratnaike, R. N.; Wangel, A. G. (Queen Elizabeth Hosp., Woodville, South Australia 5011, Australia). *Aust. N.Z. J. Med.* 7(4):349-352; 1977.

In an effort to gain information on whether the immunological changes found in celiac disease are related to its pathogenesis, 23 patients with this disease were studied while on a normal diet and again after a mean period of 15 months on a gluten-free diet. Serum levels of IgG, IgA, and IgM, total hemolytic complement, complement component C3, serum autoantibodies, and precipitins to dietary proteins were compared with those in age- and sex-matched controls. There was considerable individual variation, but as a group, patients on a normal diet had raised IgA and low IgM levels and an increased prevalence of antibody to reticulin, smooth muscle, and dietary protein. These abnormalities disappeared during the period of dietary restriction, suggesting that they are disease epiphenomena rather than primary pathogenetic factors.

4005 IMMUNOLOGICAL ABNORMALITIES IN COELIAC DISEASE AND THEIR RESPONSE TO DIETARY RESTRICTION. II. IMMUNOGLOBULIN CONTAINING CELLS, IMMUNOGLOBULINS AND DIETARY ANTIBODIES IN THE SMALL BOWEL. (Eng.) Ratnaike, R. N.; Wilson, J.; Wangel, A. G. (Queen Elizabeth Hosp., Woodville, 5011 South Australia, Australia). *Aust. N.Z. J. Med.* 7(4): 353-355; 1977.

The numbers of immunoglobulin-containing cells in jejunal mucosa were determined in 29 patients with untreated celiac disease and 28 controls. The patients had significantly increased numbers of IgM-containing cells in comparison with controls ($p < 0.001$). Seven patients were studied again after 12 months on a gluten-free diet and showed a significant reduction in the number of IgM-containing cells in comparison with that when they were on the normal diet ($p < 0.025$). The increase noted in untreated patients is therefore likely to be a manifestation of the disease rather than a primary abnormality of etiological significance.

4006 LACTOSE INTOLERANCE, DETECTED BY THE HYDROGEN BREATH TEST, INFANTS AND CHILDREN

WITH CHRONIC DIARRHEA. (Eng.) Maffei, H. V. L.; Metz, G.; Bampoe, V.; Shiner, M.; Herman, S.; Brook, C. G. D. (Faculdade de Ciencias Medicas e Biologicas, 18600 Botucatu, Sao Paulo, Brazil). *Arch. Dis. Child.* 52(10):766-771; 1977.

The value of the hydrogen breath test (HBT), adapted for use in young infants and children, in the diagnosis of lactose malabsorption was assessed in 23 children aged 2.5 months to 13 yr with chronic diarrhea and 6 patients without diarrhea. A further eight children with proven or suspected celiac disease were also investigated. The HBT was compared with the histology of the jejunal mucosa, mucosal lactase estimations, a lactose tolerance test, symptoms during the test, and follow-up after starting a lactose-free diet. The six patients without diarrhea showed no evidence of hypolactasia and the hydrogen concentration on the HBT was below 7 ppm, a level considered to be clinically nonsignificant. Twelve of the 23 patients with diarrhea had a breath H_2 concentration greater than 24 ppm, and this correlated well with their clinical symptoms during or after the test and with the remission of the diarrhea after lactose withdrawal. Of the remaining 11 patients with diarrhea whose breath H_2 concentration was lower than 25 ppm, symptoms did not improve when a lactose-free diet was started in 3, while a further 4 improved on a full diet. There was poor correlation between the HBT and the findings on the jejunal mucosal specimens. All but one of the celiac patients had an HBT less than 20 ppm, and none of these required lactose withdrawal for remission of symptoms. The HBT is a noninvasive test particularly suitable for outpatients, and it gives a useful prognostic guide to the efficacy of lactose-free diet in the treatment of chronic diarrhea in children.

4007 GASTRIC EMPTYING OF LACTOSE AND MILK IN SUBJECTS WITH LACTOSE MALABSORPTION. (Eng.) Welsh, J. D.; Hall, W. H. (Univ. Oklahoma Health Sciences Center, P.O. Box 26901, Oklahoma City, OK 73190). *Am. J. Dig. Dis.* 22(12):1060-1063; 1977.

Gastric emptying tests with 750-ml meals of glucose in water, lactose in water, plain milk, and chocolate milk were carried out in six lactose absorbers (LA) and five lactose malabsorbers (LM). The glucose and lactose meals emptied in a similar fashion in LA and LM subjects with a significant decrease in gastric emptying as the osmolarity of the meals was doubled. If the data were normalized by dividing lactose emptying by the emptying of glucose meals of twice the osmolality in each individual, the lactose malabsorbers emptied significantly more lactose ($p<0.01$). Both LA and LM subjects emptied comparable amounts of milk meals having similar osmolarity. Chocolate milk, which had a higher osmolality than plain milk, emptied more slowly than plain milk in both groups, and this difference was significant ($p<0.01$) in the LM group. In LM individuals, chocolate milk, in addition to fermented dairy products, should be tried as alternatives to total abstinance from dairy products.

4008 PRIMARY ABDOMINAL LYMPHOMA: PRESENTING MANIFESTATION OF CELIAC SPRUE OR COMPLICATING DERMATITIS HERPETIFORMIS. (Eng.) Freeman, H. J.; Weinstein, W. M.; Shnitka, T. K.; Piercey, J. R. A.; Wensel, R. H. (Dept. Medicine, Univ. Alberta, Edmonton, Alberta T6G 2G3, Canada). *Am. J. Med.* 63(4):585-594; 1977.

The association between primary abdominal lymphoma and celiac sprue or dermatitis herpetiformis was examined. During a 4-yr period, seven patients with abdominal lymphoma were found on subsequent investigation to have celiac sprue or the closely linked disorder, dermatitis herpetiformis. Five patients had a small intestinal lymphoma, one had a gastric lymphoma, and one had a retroperitoneal lymphoma. Histologically, six of the seven tumors were of a diffuse histiocytic type, and one was undifferentiated. In four patients, the ulcerating small intestinal lymphoma was initially misinterpreted as "benign ulcerative nongranulomatous jejunoileitis," a condition also reported to complicate celiac sprue. In several patients, the associated celiac sprue was clinically occult and could readily have been missed. The celiac sprue was fully responsive in five of the patients who were treated with a gluten-free diet. These studies suggest that celiac sprue and abdominal lymphoma occur together more often than is currently appreciated. The frequency of this association may be overlooked for two reasons: the associated celiac sprue is sometimes mild and may remain undetected, and early ulcerative intestinal lymphoma may be mistaken for benign ulcerative nongranulomatous jejunoileitis. Patients with abdominal lymphoma should be investigated for celiac sprue and for dermatitis herpetiformis.

4009 INTESTINAL LYMPHOMA ASSOCIATED WITH MALABSORPTION. (Eng.) Isaacson, P.; Wright, D. H. (Southampton Univ. Hosp., Southampton SO9 4XY, England). *Lancet* 1(8055):67-70; 1978.

Clinical findings in 18 patients with small intestinal lymphoma associated with villous atrophy and crypt hyperplasia of uninvolved mucosa are presented. Most patients presented with acute obstruction or perforation preceded by abdominal pain and weight loss. However, malabsorption, thought to be adult celiac disease, preceded the diagnosis of lymphoma in five cases. The lymphomas were composed of malignant histiocytes and were classified on morphological grounds as malignant histiocytosis. Immunohistochemical techniques revealed that all major immunoglobulin classes were present within malignant cells of single tumors. Characterization of this group of lymphomas as a specific entity should help in the further understanding of the relationship of malabsorption and lymphoma and in the rationalization of treatment.

4010 MACROGLOBULINEMIA AND MALABSORPTION. (Eng.) Tubbs, R. R.; McLaughlin, J. P.; Winkelman, E. I.; Deodhar, S. D.; Hewlett, J. S. (Cleveland Clinic, Cleveland, OH). *Cleve. Clin. Q.* 44(4):189-191; 1977.

Intestinal involvement in Waldenstrom's macroglobulinemia (IgM monoclonal [kappa] gammopathy) in a 58-yr-old woman is presented because the phenomenon is rare in this disease. The patient had been treated for anemia (symptoms of fatigue, weakness, and weight loss) with low-fat diet, prednisone (30 mg/day), and thyroid USP (3 grains/day), had undergone an exploratory laparotomy that disclosed lymphangiectasia of the intestinal lymphatics and mesenteric lymph nodes, and was treated with cyclophosphamide (50 mg p.o. twice daily) and prednisone (60 mg p.o. every other day) to resolve malabsorption, splenomegaly, IgM monoclonal (kappa) gammopathy, anorexia, and weight loss. The patient was hospitalized for pneumonia (resolved with cephalothin) and then for hyperpyrexia, athralgias, visual disturbances, anemia, and leukopenia; *Staphylococcus aureus* bacteremia was found. The patient died despite reverse isolation, several transfusions, and antibiotic therapy with multiple antimicrobial agents. Histologically, at necropsy, the gallbladder contained a moderate mucosal and submucosal chronic inflammatory infiltrate. The jejunum, mesentery, and mesenteric lymph nodes demonstrated a marked lymphectasia. Additionally, necropsy tissues revealed severe organizing bronchopneumonia and focal myocardial fibrosis. A mixed diffuse infiltrate of mature lymphocytes, plasma cells, plasmacytoid lymphocytes, and occasional lymphoid cells with Dutcher bodies was present in lung, bone marrow, spleen, and lymph nodes. Deposition of all immunoglobulin heavy chains and both light chains within the inspissated material in dilated submucosal lymphatics and intestinal lacteals was shown. There was no extracellular deposition of IgM within the small bowel other than within the dilated lymphatic channels. It appears that mucosal deposition of the monoclonal immunoglobulin is the primary pathogenetic mechanism, and that obstruction and stasis of lymphatic circulation due to effacement of mesenteric lymph nodes by the malignant infiltrate are of primary importance in the pathogenesis of the lesion.

4011 PATHOPHYSIOLOGY AND CLINICAL ASPECTS OF MALASSIMILATION. (Ger.) Classen, M.; Hoffmann, L. (I. Medizinische Abteilung, Allgemeines Krankenhaus Barmbek, Rubenkamp 148, D-2000 Hamburg 60, W. Germany). *Med. Klin.* 72(13):533-541; 1977.

4012 POSSIBILITIES OF SURGICAL TREATMENT OF MALASSIMILATION. (Ger.) Farthmann, E. (Chirurgische Universitatsklinik, Abteilung fur Allgemeinchirurgie, Martinistrasse 52, D-2000 Hamburg 20, W. Germany). *Med. Klin.* 72(13):542-548; 1977.

4013 INFANTILE INTESTINAL ENZYMOPATHY. (Ita.) Schreier, K. (Municipal Pediatric Clinic, Nurnberg, W. Germany). *Minerva Med.* 68(15):951-959; 1977.

See also, 3490, 3809, 3841, 3865, 3866, 3874, 3884, 3897, 4000, 4262, 4275, 4285.

LARGE INTESTINE

4014 APPENDICEAL ABSCESS REVISITED. (Eng.) Bradley, E. L., III; Isaacs, J. (Emory Univ. Sch. Medicine, 69 Butler St. SE, Atlanta, GA 30303). *Arch. Surg.* 113(2):130-132; 1978.

The occurrence of appendiceal abscess was reviewed for the period 1962-1976. Two percent of 2,621 patients with acute appendicitis developed appendiceal abscess. Sixty-one of 68 patients underwent surgical drainage of the abscess, with a 28% complication rate. Interval appendectomy was performed in 42 cases, with a 19% complication rate. Two patients died. These rates do not differ appreciably from those reported during the pre-antibiotic era. Recurrent appendicitis developed in only 1 of 13 patients not undergoing interval appendectomy during a follow-up period averaging 5 yr. Interval appendectomy should be withheld only in those poor-risk patients in whom the 10% to 20% incidence of recurrent appendicitis seems the smaller risk. Although the number of patients developing appendiceal abscess represents a decline in frequency from earlier studies, further decreases in incidence could be effected by increased patient education.

4015 POLICY OF LOCAL EXCISION FOR EARLY CANCER OF THE COLORECTUM. (Eng.) Morson, B. C.; Bussey, H. J. R.; Samoorian, S. (St. Mark's Hosp., London, England). *Gut* 18(12):1045-1050; 1977.

The results of local excisions performed over a 25-yr period in 143 patients with cancer of the rectum and distal colon are described to evaluate a policy of local excision or total biopsy for certain selected colorectal cancers. Many of the lesions presented as malignant polyps. All procedures were followed by a thorough histological examination to evaluate the need for further radical operation. The grade of the malignancy was low in 60 cases, average in 77, and high in 6. The tumor diameter was <2 cm in 86 cases, 2-3 cm in 26, 3-4 cm in 15, and >5 cm in 5. In 115 patients, the carcinoma did not spread beyond the submucosa of the rectal or colonic wall. In 20 cases, it penetrated into the muscularis propria and in 7 cases it reached the extramural tissue. In 102 patients, the local excision was regarded as histologically complete with 91/102 accomplished by local excision only; recurrence was observed in only 3 of the 91 patients and one of

these must be regarded as a failure of the policy. In eight cases, the local excision was followed by a major operation because the local excision was suspected to be incomplete; only two patients from this group died 2 and 3.5 yr after treatment with evidence of recurrence, and the evidence indicates that these were not policy failures. In 14 of 18 patients with doubtfully complete local excision, no further operation was performed for various reasons; there was evidence of recurrence in only 2 cases, and these were classed as policy failures. In four patients with doubtfully complete local excision, a major operation was performed that showed residual tumor growth at the site of local excision in two cases, moderately differentiated carcinoma spreading into muscularis propria or submucosa in two cases, and no residual tumor in the other two cases. In 23 cases the local excision was regarded as histologically incomplete; 14/23 had had palliative local excisions and were not subjected to further surgical treatment due to various contraindications; only 5 recurrences were observed. Residual tumor growth was found in only three of the nine patients who had a major operation following incomplete local excision. The crude and corrected 5-yr survival rates for patients with complete, doubtfully complete, and incomplete local excisions were 82% and 100%, 64% and 96%, and 57% and 83%, resp. Because of the good results, local excision should be regarded as an established alternative to partial colectomy, anterior resection, and abdominoperineal excision in carefully selected patients.

4016 TUMOR-HOST RELATIONSHIPS IN COLORECTAL CARCINOMA. (Eng.) Syrjanen, K. J.; Hjelt, L. H. (Jorvi Hosp., 02740, Espoo 74, Finland). *Dis. Colon Rectum* 21(1):29-36; 1978.

Histological studies of colorectal carcinoma, its surrounding stroma, and regional lymph nodes with special reference to the morphology of possible tumor-host relationships were performed in 87 consecutive patients and 5-year follow-ups completed for 74 patients. The tumors were graded according to the nuclear structure as slight nuclear atypia (grade I), moderate atypia (grade II), strong atypia (grade III), and profound atypia (grade IV). Tumor-derived mucus content was estimated as low, moderate, or high. The stromal lymphocyte and mast cell reactions and the mast cell reaction in the nodes were graded weak, moderate, or strong. Lymph node follicular hyperplasia was classified from 0 to 4 based on the number of follicles seen. Paracortical activity was graded into three classes on the basis of the small lymphocyte content, the height of the endothelial cells of the postcapillary venules, and the occurrence of lymphocytes in their lumena. Sinus reactions were classified as sinus histiocytosis, degenerative sinus histiocytosis, nonspecific sinus reactions, and no sinus reactions. The extent of metastases was graded from 1 to 4 according to the node area invaded by the tumor. A direct correlation was found between tumor grade and the 5-yr prognosis, although the sample size was too small for statistical analysis. Five-year survival was 100%, 50.0%, 36.7%, and 16.7% for patients with tumors graded I-IV, resp. Metastases were more frequent in patients with grade IV and grade III tumors (50% and 43.5%, resp.) than in those with grade II or grade I tumors (7.1% and 0.0%, resp.), and prognosis appears poorer for those with nodal metastases. Regardless of tumor grade, 5-yr survival rates seem to be independent of the mucous content. There appears to be a direct positive correlation between stromal lymphocyte reaction and the 5-yr survival rate. A similar correlation, although not so strong, was observed between the prognosis and the mast cell reaction. Follicular hyperplasia of lymph nodes did not correlate with the appearance of nodal metastases. The latter was, however, inversely correlated with paracortical activity. Sinus histiocytosis was never associated with nodal metastases. It is concluded that complex factors of both tumor and host origin modify local invasiveness of colorectal carcinoma and greatly affect the prognosis.

4017 CHEMOPROPHYLAXIS FOR PATIENTS WITH POST-OPERATIVE HIGH RISK COLORECTAL CANCER. (Eng.) Li, M. C.; Ross, S. T. *In: Adjuvant Therapy of Cancer.* (Amsterdam: Elsevier/North-Holland Biomedical Press): 273-277; 1977.

The effectiveness of short-term fluorouracil (FU) chemoprophylaxis begun 4-6 weeks after curative surgery was evaluated in 183 patients with Duke's class B or C colorectal cancer who were operated on between 1965 and 1970. The controls were a group of similar patients operated on between 1960 and 1965 but who did not receive the drug. Patients <65 yr old, >60 kg in weight, or in good nutritional state received 1,000 mg FU i.v. push on day 1, 500 mg i.v. for the next 4 days, and then 500 mg i.v. once after 4 weeks. Patients >65 yr old, <60 kg in weight, or in poor nutritional state received FU (500 mg, i.v. push) for 5 days and one repeat dose after 4 weeks. The 5-yr survival rate is calculated for patients with no evidence of disease (NED). In Duke's class C disease, the rate was 24.3% with surgery alone, but was 57.7% ($p<0.01$) when treatment followed surgery. The 5-year NED rate in Duke's class B disease was 58.8% with surgery alone and 81.6% ($p<0.02$) with surgery and FU treatment. The 1-, 2-, and 3-yr survival rates in Duke's class C disease are strikingly different for the experimental and control groups, but the difference in Duke's class B disease was not significant until the 5th yr. FU therapy appears to offer a statistically significant improvement in the 5-yr disease-free survival rates of patients with Duke's class B or C disease when used in a carefully selected and controlled setting.

4018 LEIOMYOMAS OF THE RECTUM AND ANAL CANAL: REPORT OF SIX CASES AND REVIEW OF THE LITERATURE. (Eng.) Kusminsky, R. E.; Bailey, W. (6064 Village Glen Drive, Apt. 4153, Dallas, Texas 75206). *Dis. Colon Rectum* 20(7):580-599; 1977.

A review is presented of 79 cases of leiomyoma of the rectum and anal canal reported in literature from 1959 to 1975, of which six cases (author's series) are presented in detail. The patient's age and sex, the size and location of the tumor, the symptoms of the lesion and their duration, the preoperative diagnosis, treatment, and follow-up comments are presented in tabular form for the 79 cases. Since 1872, 168 rectal leiomyomas have been reported in the literature, indicating a very low incidence of the disease. The incidence, etiology, location, age and sex incidence, signs and symptoms, diagnosis, pathology, and treatment of the disease are discussed. The incidence of these lesions is greatest between the ages of 40 and 59 yr. Leiomyomas located in the anal canal and sphincter are the rarest (a case report is given; 11 cases total are found in the literature). Most patients have a combination of symptoms among which most frequent are the presence of a palpable mass, bleeding, constipation, and pain. Diagnosis is usually obtained by digital examination of the rectum. Those tumors with an original diameter of 5 cm or more show a stronger tendency to recur and/or become malignant. It is concluded that leiomyomas must be approached with serious consideration of radical treatment, particularly when their largest diameter is 5 cm or more. More adequate follow-up studies of these patients are suggested.

4019 THE PATHOPHYSIOLOGIC BASIS FOR THE ANGIOGRAPHIC SIGNS OF VASCULAR ECTASIAS OF THE COLON. (Eng.) Boley, S. J.; Sprayregen, S.; Sammartano, R. J.; Adams, A.; Kleinhaus, S. (Montefiore Hosp. and Medical Center, 111 East 210th St., Bronx, NY 10467). *Radiology* 125(3):615-621; 1977.

Forty-five superior mesenteric angiograms from 25 patients with histologically and radiographically diagnosed colonic ectasia were reviewed to determine reliable individual diagnostic signs. Of eight angiographic signs evaluated, four were considered important, reliable, and readily identifiable, independent of observer interpretation: (1) a densely opacified, slowly emptying, dilated, tortuous, intramural cecal vein that remains visualized after other mesenteric veins have emptied (seen in 23 of the 25 patients); (2) a vascular tuft, best visualized in the arterial phase and usually located at the termination of a branch of the ileocolic artery (seen in 17); (3) an early filling vein that visualized within 4-5 sec (seen in 14), usually a local vein in the cecum or right colon or the ileocolic vein; and (4) an intraluminal, localized extravasation of contrast material that usually appeared during the arterial phase and persisted throughout the study (seen in 2). The first three signs were present in 11 of the 25 patients. Eight patients displayed combinations of two signs. Five patients demonstrated only the dense, slowly emptying vein, and one patient had only the early filling vein. In serial angiograms done on three of four patients, the late emptying intramural vein was found months to years before the other signs could be identified; it was the earliest and most frequently observed angiographic sign of ectasia. The vascular tuft was a less frequent sign that developed next on the serial angiograms and appears to represent a more advanced stage of the degenerative process. The early filling vein corresponds to the final stage of the process. Vascular ectasias appear to be degenerative lesions requiring many years to develop, the direct cause of which appears to be repeated, partial, intermittent, low-grade obstruction of the submucosal veins, especially where they pierce the muscle layers of the colon. Dilatation and tortuosity of the submucosal vein and then of the venules of the arteriolar-capillary-venular units draining into it occurs, leading to alterations in the arteries supplying the area and the extramural vein draining it.

4020 HISTOLOGIC STUDIES OF RECTOCOLIC AGANGLIONOSIS AND ALLIED DISEASES. (Eng.) Munakata, K.; Okabe, I.; Morita, K. (Nihon Univ. Sch. Medicine, Oyaguchi, Itabashi-ku, Tokyo, Japan). *J. Pediatr. Surg.* 13(1):67-75; 1978.

Histologic studies of the rectum and large bowel of newborn children with provisional clinical diagnosis of Hirschsprung's disease were performed using a silver impregnation technique. The state of maturity of the ganglia was defined by studying intestinal specimens obtained at operation for aganglionosis in two fetuses and for disease other than Hirschsprung's in two newborn infants. The normal state of the internal anal sphincter was studied in rectal autopsy specimens from two suckling infants and one newborn, none of whom had defecation problems. In the fetuses and newborn infants, Auerbach's plexus was rhombic in form, and the number of ganglia/plexus was about 50. No ganglion cells were found, and many nonmedullated nerve fibers were present in aganglionic segments. Solitary or clustered ganglia and proliferations of nonmedullated nerve fibers were present in the distal portion of the transitional zone. A small number of ganglia per plexus were found in the proximal part of the transitional zone, and a complete plexus was present in the proximal normal intestine. In children aged 6-9 months, Auerbach's plexus exhibited a network structure up to about 2 mm proximally from the lowest part of the internal anal sphincter, and in the newborn infants up to about 4 mm proximally; nerve fibers branched off from these plexuses and ran towards the internal anal sphincters. In 30 newborn infants diagnosed to have Hirschsprung's disease, double rectal suction biopsies were performed following colostomy or ileostomy; 8 of them had further biopsies at 6-9 months. In 22 cases, many or slight proliferations of acetylcholinesterase nerve fibers were observed; in 8 cases, however, hardly any proliferation was recognized, and small ganglia were present. Detailed histologic examination of the bowel, with silver impregnation, revealed that six of these eight cases were hypoganglionic. In five cases, there was no plexus formation but solitary or clustering ganglia were present. In one patient, there

was incomplete formation of the plexus and ganglia were observed. Complete plexus gradually formed in proximal intestine in all six cases; in four cases, the diseased segment was short, involving only the rectum and in two cases, it extended to the middle of the descending colon. Proliferation of acetylcholinesterase nerve fibers was rarely observed in the lamina propria or lamina muscularis mucosae of rectal biopsies in the newborns, but these arose by 6-9 months. Small Meisner's ganglia were present in all newborn rectal biopsies. Immaturity of the ganglia (long type) was recognized in a newborn infant who had aganglionosis in the rectum, normal ganglia in the transverse colon, and scarsely any acetylcholinesterase nerve fibers in the lamina propria or lamina muscularis mucosae. Plexus formation and numbers of ganglia corresponded to controls, but the intramural ganglion cells were small and monopolar from the jejunum to the rectum. Despite intravenous hyperalimentation, the patient died 4 months after birth. A patient with microcolon and aganglionic small bowel had no acetylcholinesterase nerve fibers in a rectal biopsy specimen, although small Meisner's ganglia were present. Histologic examination of intestinal autopsy specimens showed a narrow plexus, diminished numbers of ganglia per plexus, and small ganglia from jejunum to anus. It is suggested that the internal anal sphincter muscle at the dentate line is under the control of Auerbach's plexus and ganglia. Hypoganglionosis can be diagnosed as Hirschsprung's disease from the characteristic findings of acetylcholinesterase nerve fibers in the rectal mucosa, but immaturity of the ganglia and hypogenesis can only be diagnosed by histologic studies that include studies of the form of the intramural plexus, the numbers of ganglia per plexus, and the size of the ganglia.

4021 HISTOCOMPATIBILITY ANTIGENS AND THE ARTHRITIS OF CHRONIC INFLAMMATORY BOWEL DISEASE. (Eng.) Nicholls, A. (No affiliation given). *Clin. Rheum. Dis.* 3(2):265-280; 1977.

Various types of arthritis associated with ulcerative colitis (UC) and Crohn's disease (CD) are discussed and epidemiological and genetic studies are reviewed to investigate whether other conditions associated with ankylosing spondylitis also have a high frequency of the HLA-B27 antigen. Arthritis associated with chronic inflammatory bowel disease, family associations between chronic inflammatory bowel disease and ankylosing spondylitis, the occurrence of spinal disease in patients and relatives of patients with inflammatory bowel disease, HLA antigens in inflammatory bowel disease and its accompanying arthritis, HLA antigens in the arthritis of inflammatory bowel disease, other genetic markers (blood groups, glucose-6-phosphate dehydrogenase activity, allergic diseases, infective agents), and genetic interpretation are discussed in detail. No definite association has been shown between the distribution of HLA antigens and CD, UC, or the enteropathic arthritis complicating these diseases. HLA-B27 is present in a high proportion of patients with spondylitis complicating inflammatory bowel disease; but not as high as in "idiopathic" ankylosing spondylitis. It is suggested that the presence of B27 in a patient with inflammatory bowel disease confers a greater risk of the development of ankylosing spondylitis than in subjects without bowel disease.

4022 MANAGEMENT OF VOLVULUS OF THE COLON. (Eng.) Wertkin, M. G.; Aufses, A. H., Jr. (Box 764, Mount Sinai Hosp., Fifth Ave. and 100th St., New York, NY 10029). *Dis. Colon Rectum* 21(1): 40-45; 1978.

The cases of 32 patients with sigmoidal (23), cecal (8), or transverse (1) volvulus of the colon are reviewed and compared with previously reported series in an attempt to define guidelines for the treatment of this entity. In the sigmoidal volvulus group, there were cases of significant neurologic or psychiatric disease (6), cardiovascular disease (7), diabetes mellitus (2), prostatic disease (4), and ulcerative colitis quiescent at the time of volvulus (1). Nonoperative reduction (attempted in 18 patients) was successful with sigmoidoscopy (12), colonoscopy (3), or barium enema (1); it was unsuccessful by sigmoidoscopy in two patients, one of whom died of shock following sigmoid perforation, and there were five recurrences. Fifteen patients underwent 16 operative procedures: 7 emergency treatments (obstructive resection in 5), three-stage resection in 1, detorsion and sigmoidopexy in 1, and 9 elective treatments (sigmoidal resection with primary anastomosis in 8 and obstructive resection in 1). There was one recurrence and one death. In the cecal volvulus group, there were cases of significant cardiovascular disease (2), chronic obstructive pulmonary disease (1), sickle-cell anemia (1), previously diagnosed irritable bowel syndrome (1), previous appendectomy (1), and previous cholecystectomy (1). Nonoperative treatment (attempted in 3 patients) was successful by barium enema (2) and unsuccessful by long intestinal tube (1). Six patients underwent operative procedures, with no deaths and no recurrences. Detorsion (2); detorsion, cecopexy, and cecostomy (2); detorsion and cecopexy (1); and detorsion and cecostomy (1) were performed on an emergency basis, except for one detorsion. Transverse volvulus accompanied by gangrenous bowel was successfully treated operatively. In all cases of sigmoidal volvulus, sigmoidal resection with primary anastomosis after nonoperative reduction is the treatment of choice; obstructive resection is indicated as definitive therapy where operation is mandatory. Appropriate operation appears the treatment of choice for cecal volvulus. The treatment of choice for volvulus of the transverse colon is resection of the redundant segment of colon with end-to-end anastomosis or obstructive resection in the presence of gangrenous bowel or when anastomosis is deemed hazardous.

4023 THE IMMEDIATE RESULTS OF ABDOMINAL PROCTECTOMY WITH DOWNWARD TRANSPOSITION OF THE SIGMOID IN OBESE AND ELDERLY PATIENTS. (Rus.)

Fedorov, V. D.; Pokrovskii, G. A.; Brusilovskii, M. I.; Odaryuk, T. S. (Scientific Res. Lab. Proctology with Clinic, Moscow, USSR). *Khirurgiia (Mosk.)* (10):57-61; 1977.

4024 INCOMPETENCE OF ANASTOMOSIS IN ABDOMINAL RESECTION OF THE RECTUM AND SIGMOID FOR CANCER. (Rus.) Martynyuk, V. V. (N. N. Petrov Scientific Res. Inst. Oncology, Leningrad, USSR). *Khirurgiia (Mosk.)* (10):61-64; 1977.

4025 SURGICAL TREATMENT OF RECTOSIGMOID CANCER. (Rus.) Knysh, V. I.; Yudin, I. Yu.; Nurov, A. U.; Ivanov, V. M.; Tasryuk, V. F. (Oncological Science Center, Moscow, USSR). *Khirurgiia (Mosk.)* (10):65-69; 1977.

4026 COMBINED TREATMENT OF IMMOBILE RECTAL CANCER WITH THE USE OF PREOPERATIVE INTENSIVE FRACTIONAL IRRADIATION. (Rus.) Zybina, M. A.; Chernichenko, V. A.; Lurye-Pokrovskaya, T. A.; Arungazyeva, V. V.; Zaichuk, A. I. (Kiev Rentgeno-Radiology and Oncology Inst., Kiev, USSR). *Khirurgiia (Mosk.)* (10):72-76; 1977.

4027 PREOPERATIVE PREPARATION OF RECTAL CANCER PATIENTS WITH CONCOMITANT ARTERIAL HYPERTENSION. (Rus.) Brusilovsky, M. N.; Eropkina, A. G.; Eropkin, P. V.; Alexeeva, V. V. (Surgical Div., Scientific Res. Lab. Proctology with Clinic, Moscow, USSR). *Khirurgiia (Mosk.)* (10):77-81; 1977.

4028 PRINCIPLES OF PLANNING A POSTSURGERY REHABILITATION PROGRAM FOR RECTAL CANCER PATIENTS. (Rus.) Gerasimenko, V. N.; Protchenko, N. V.; Artyushenko, Yu. V.; Gegenava, Sh. P. (Div. Rehabilitation, Oncological Science Center, Acad. Medical Science USSR, Moscow, USSR). *Khirurgiia (Mosk.)* (10):81-85; 1977.

4029 BOWEL DECOMPRESSION FOR THE TREATMENT OF DYNAMIC INTESTINAL OBSTRUCTION. (Rus.) Shal'kov, J. L.; Nechitailo, P. E.; Grishina, T. A. (Kharkov Scientific Res. Inst. General and Emergency Surgery, Kharkov, USSR). *Vest. Khir.* 118(2):34-38; 1977.

4030 LINEAR PNEUMATOSIS OF THE COLON. (Fre.) Dournovo, P.; Marche, C.; Thibault, P.; Poirson, B.; Corcelle, P. (Hopital Bichat, 170, bd Ney, 75877 Paris Cedex 18, France). *Sem. Hop. Paris* 53(11/12):701-702; 1977.

4031 PRIMARY LINITIS PLASTICA OF THE COLON AND RECTUM. (Eng.) Tootla, F. S.; Stein, H.; Bernacki, E.; Kiechle, F. L. (Professional Building, 909 Woodward Ave., Pontiac, MI 48053). *Am. J. Proctol.* 28(5):29-34; 1977.

4032 MUCIN HISTOCHEMISTRY IN THE DETECTION OF EARLY MALIGNANCY IN THE COLONIC EPITHELIUM. (Eng.) Filipe, M. I. (Westminster Medical Sch., Udall St., London, SW1P 2PP, England). *Adv. Exp. Med. Biol.* 89:413-422; 1977.

4033 GLYCOPROTEIN ALTERATION IN HUMAN COLONIC ADENOCARCINOMA. (Eng.) Kim, Y. S. (Veterans Admin. Hosp., 4150 Clement St., San Francisco, CA 94121). *Adv. Exp. Med. Biol.* 89: 443-468; 1977.

4034 ISCHAEMIC COLITIS AND DRUG ABUSE. (Eng.) Turnbull, A. R.; Isaacson, P. (Southampton Univ. Hosp., Southampton, England). *Br. Med. J.* 2(6093):1000; 1977.

4035 COLONIC DIVERTICULOSIS IN A CHILD. (Eng.) Rees, B. I.; Griffin, P. J. A. (Univ. Hosp. Wales, Cardiff, Wales). *Br. Med. J.* 2(6096): 1194; 1977.

4036 NEONATAL INTUSSUSCEPTION: REPORT OF 12 CASES. (Eng.) Patriquin, H. B.; Afshani, E.; Effman, E.; Griscom, N. T.; Johnson, F.; Kramer, S. S.; *et al.* (Centre Hospitalier Universitaire de Sherbrooke, Sherbrooke, Quebec, Canada). *Radiology* 125(2):463-466; 1977.

4037 MALPOSITION OF THE COLON IN RIGHT RENAL AGENESIS, ECTOPIA, AND ANTERIOR NEPHRECTOMY. (Eng.) Curtis, J. A.; Sadhu, V.; Steiner, R. M. (Thomas Jefferson Univ. Hosp., Philadelphia, PA 19107). *Am. J. Roentgenol.* 129(5):845-850; 1977.

4038 NEURONAL COLONIC DYSPLASIA: AN UNUSUAL ASSOCIATION OF HIRSCHSPRUNG'S DISEASE. (Eng.) Puri, P.; Lake, B. D.; Nixon, H. H.; Mishalany, H.; Claireaux, A. E. (Hosp. Sick Children, Great Ormond St., London WC1N 3JH, England). *J. Pediatr. Surg.* 12(5):681-685; 1977.

4039 ENDOSCOPIC APPEARANCE OF AUTO-AMPUTATED POLYPS IN JUVENILE POLYPOSIS COLI. (Eng.) Nelson, E. W., Jr.; Rodgers, B. M.; Zawatzky, L. (J. Hillis Miller Health Center, Box J-214, Gainesville, FL 32610). *J. Pediatr. Surg.* 12(5): 773-776; 1977.

4040 THE IDENTIFICATION OF INDIVIDUALS AT HIGH RISK FOR LARGE BOWEL CANCER: AN OVERVIEW. (Eng.) Lipkin, M. (Memorial Sloan-Kettering Cancer Center, 1275 York Ave., New York, NY 10021). *Cancer* 40(5, Suppl.):2523-2530; 1977.

4041 SURGICAL AND MEDICAL MEASURES IN PREVENTION OF LARGE BOWEL CANCER. (Eng.) DeCosse,

J. J.; Condon, R. E.; Adams, M. B. (8700 W. Wisconsin Ave., Milwaukee, WI 53226). *Cancer* 40(5, Suppl.):2549-2552; 1977.

4042 COLON CANCER PREVENTION: TODAY'S CHALLENGE TO BIOMEDICAL SCIENTISTS AND CLINICAL INVESTIGATORS. (Eng.) Wynder, E. L.; Reddy, B. S. (Naylor Dana Inst. Disease Prevention, American Health Foundation, Valhalla, NY 10595). *Cancer* 40(5, Suppl.):2565-2571; 1977.

4043 THE ROLE OF EARLY DIAGNOSIS IN CONTROLLING LARGE BOWEL CANCER: AN OVERVIEW. (Eng.) Sherlock, P.; Winawer, S. J. (Memorial Sloan-Kettering Cancer Center, 1275 York Ave., New York, NY 10021). *Cancer* 40(5, Suppl.):2609-2615; 1977.

4044 HIRSCHSPRUNG'S DISEASE AND CONGENITAL DEAFNESS: FAMILIAL ASSOCIATION. (Eng.) Weinberg, A. G.; Currarino, G.; Besserman, A. M. (1935 Amelia, Dallas, TX 75235). *Hum. Genet.* 38(2): 157-161; 1977.

4045 TOTAL INTESTINAL AGANGLIONOSIS: AN AUTOSOMAL RECESSIVE CONDITION? (Eng.) MacKinnon, A. E.; Cohen, S. J. (Booth Hall Children's Hosp., Charleston Rd., Blackley, Manchester M9 2AA, England). *Arch. Dis. Child.* 52(11):898-899; 1977.

4046 COLON CANCER: ETIOLOGICAL ISSUES AND PROSPECTS FOR EARLY DETECTION. (Eng.) Jaco, D. (Dept. Family and Community Medicine, Univ. Missouri--Columbia, Columbia, MO 65201). *Prev. Med.* 6(4):535-544; 1977.

4047 RECURRENT APPENDICITIS FOLLOWING APPENDECTOMY. (Eng.) Wilder, J. R.; Schweitzer, D. L.; Aguam, A. S. (Hosp. Joint Diseases, New York, NY). *Abdom. Surg.* 19(6): 147-150; 1977.

4048 BENIGN LYMPHOID HYPERPLASIA OF THE COLON. (Eng.) Liebman, W. M.; Rosental, E. (Dept. Pediatrics, Univ. California, San Francisco, San Francisco, CA 94143). *West. J. Med.* 127(5): 416-418; 1977.

4049 PROLONGED ERYTHROCYTE T-POLYAGGLUTINATION IN TWO CHILDREN WITH BOWEL DISORDERS. (Eng.) Obeid, D.; Bird, G. W. G.; Wingham, J. (West Midlands Regional Blood Transfusion Service, Vincent Drive, Edgbaston, Birmingham B15 2SG, England). *J. Clin. Pathol.* 30(10):953-955; 1977.

4050 Streptococcus milleri IN THE APPENDIX. (Eng.) Poole, P. M.; Wilson, G. (Chester City Hosp., Chester CH2 3EG, England). *J. Clin. Pathol.* 30(10):937-942; 1977.

4051 ADENOSINE 3',5' CYCLIC MONOPHOSPHATE LEVELS IN COLONIC POLYPS AND RECTAL CARCINOMA IN MAN. (Eng.) Britton, D. C.; Cornell, C.; Latner, A. L.; Tregoning, D.; Turner, G. A. (Royal Victoria Infirmary, Newcastle upon Tyne, England). *IRCS Med. Sci. Cancer* 5(10):495; 1977.

See also, 3472, 3775, 3785, 3793, 3796, 3817, 3832, 3863, 3872, 3882, 3888, 3893, 3994, 4053, 4055, 4180, 4205, 4236, 4239, 4240, 4243, 4248, 4260, 4264, 4265, 4274, 4278, 4279, 4281.

LARGE INTESTINE

Ulcerative Colitis

4052 INFLUENCE OF AN ELEMENTAL DIET ON PROTEIN EXUDATION IN CHRONIC INFLAMMATORY BOWEL DISEASE. (Eng.) Axelsson, C. K.; Jarnum, S. (Rigshospitalet, 2100 Copenhagen O, Denmark). *Digestion* 16(1/2):77-86; 1977.

Using ^{131}I-albumin, intestinal protein loss was investigated as a possible indicator of the therapeutic effect of an elemental diet in the treatment of 13 patients with chronic inflammatory bowel disease (9 with ulcerative colitis and 4 with Crohn's disease). Prior prednisone treatment was given in eight cases; in five patients who failed to respond or who responded unsatisfactorily to dietary treatment, prednisone treatment was started or increased after 9-13 days of the dietary treatment. ^{131}I-albumin studies showed no significant change of albumin degradation and, by inference, of intestinal protein loss in the group as a whole. Nevertheless, clinical remission occurred in five patients. A markedly elevated initial albumin breakdown (>16%/day) was associated with poor outlook for the success of treatment. It is concluded that measurement of intestinal protein leakage is of no

predictive value as regards the effect of treatment of chronic inflammatory bowel disease with elemental diet. Apparently, diminishing protein exudation is a late phenomenon during a course of clinical remission.

4053 IMMUNOLOGICAL STUDIES IN ULCERATIVE COLITIS. VIII. ANTIBODIES TO COLON ANTIGEN IN PATIENTS WITH ULCERATIVE COLITIS, CROHN'S DISEASE, AND OTHER DISEASES. (Eng.) Carlsson, H. E.; Lagercrantz, R.; Perlmann, P. (Dept. Immunology, Wenner-Gren Inst., Univ. Stockholm, S-106 91 Stockholm, Sweden). *Scand. J. Gastroenterol.* 12(6):707-714; 1977.

The sera of 516 patients with ulcerative colitis, 148 with Crohn's disease, 77 with gastroenteritis, 97 with irritable colon, 12 with salmonellosis, 13 with liver cirrhosis, 16 with urinary tract infection, 158 with other nongastrointestinal diseases, and 158 healthy controls were examined for antibodies to colon antigen. In addition, the reactivity with Common Antigen (CA) of sera from the patients with Crohn's disease, 122 patients with polyposis coli, and 60 relatives of polyposis coli patients was examined. Sera from patients with ulcerative colitis or Crohn's disease had elevated titers to colon antigen from germ-free rats significantly more often ($p<0.05$) than did sera from patients with gastroenteritis, irritable colon, nongastrointestinal diseases, and healthy controls. Elevated anticolon titers in significant frequency were also found in patients with liver cirrhosis, urinary tract infections, and in polyposis coli and their relatives. Women with ulcerative colitis had, on an average, higher titers than men, especially those 30 yr old and over. In Crohn's disease, the antibody titers often increased with time, which was not the case in ulcerative colitis and nongastrointestinal diseases. In conjunction with the results of previous studies, the present study supports the assumption that the antibodies in ulcerative colitis patients react with antigenic determinants distinct from those recognized by the colon antibodies present in other groups, including patients with Crohn's disease and polyposis coli.

4054 EVIDENCE FOR CIRCULATING IMMUNE COMPLEXES IN ULCERATIVE COLITIS [Abstract]. (Eng.) Einstein, E. (Rhode Island Hosp., Providence, RI). *Gastroenterology* 72(5, Part 2):1187; 1977.

4055 ISOLATION AND CHARACTERIZATION OF COLONIC TISSUE BOUND ANTIBODIES FROM PATIENTS WITH ULCERATIVE COLITIS [Abstract]. (Eng.) Das, K.; Dubin, R. (Albert Einstein Coll. Medicine, Bronx, NY). *Gastroenterology* 72(5, Part 2):1043; 1977.

4056 IMPAIRED LYMPHOCYTE FUNCTION IN PATIENTS WITH INFLAMMATORY BOWEL DISEASE (IBD) [Abstract]. (Eng.) Davis, P.; Lyanga, J.; Thomson, A. B. R. (Univ. Alberta, Edmonton, Alberta, Canada). *Gastroenterology* 72(5, Part 2):1044; 1977.

4057 SELECTIVE LYSOSOMAL ENZYME RELEASE FROM MACROPHAGES (MO) STIMULATED BY BACTERIAL LIPOPOLYSACCHARIDES (LPS)--A MECHANISM FOR THE PATHOGENESIS OF INFLAMMATORY BOWEL DISEASE (IBD) [Abstract]. (Eng.) Doe, W. F.; Yang, D.; Henson, P. M. (Scripps Clinic, La Jolla, CA). *Gastroenterology* 72(5, Part 2):1157; 1977.

4058 SERUM-BILE ACIDS IN INFLAMMATORY BOWEL DISEASE [Letter to Editor]. (Eng.) Mihas, A. A.; Gibson, R. G.; Levy, N.; Hirschowitz, B. I. (Div. Gastroenterology, Univ. Alabama, Birmingham, AL 35294). *Lancet* 2(8034):405-406; 1977.

See also, 3530, 4021, 4278.

PANCREAS

4059 DIAGNOSIS OF PANCREATIC CANCER BY ENDOSCOPIC RETROGRADE CHOLANGIOPANCREATOGRAPHY AND PANCREOZYMIN SECRETIN TEST. (Eng.) Nakano, S.; Takeda, I.; Watashiki, H.; Nakamura, M. (Ogaki Municipal Hosp., 4-86 Minaminokawa-machi, Ogaki City, 503 Japan). *Gastroenterol. Jpn.* 12(4): 263-268; 1977.

The cases of 80 patients with pancreatic cancer are reviewed to evaluate the significance and limitations of endoscopic retrograde cholangiopancreatography (ERCP) and the pancreozymin-secretin (PS) test for the precise and detailed diagnosis of the carcinoma of the pancreas. The patients were divided into 10 groups according to the location and size of the tumor. Changes of the common bile duct (CBD), the main pancreatic duct (MPD), and the accessory pancreatic duct (APD) and duodenal loop obtained by percutaneous transhepatic cholangiography (PTC), drip infusion cholangiography (DIC), hypotonic duodenography (HDG), and ERCP were employed for this classification. In cases of pancreatic head cancer in which the tumor is located near the CBD and apart from the MPD, the pancreatogram remained intact or showed slight narrowing with almost normal pancreatic function. The CBD was obstructed either completely or incompletely. Remarkable impairments in the exocrine pancreas and

in bile secretion were observed in cases of tumors involving the MPD, APD, and CBD, accompanied by notable changes in the cholangiopancreatogram. However, varying degrees of impairment in the exocrine pancreas and the bile secretion were observed in cases of pancreatic head cancer apart from the MPD, CBD, and APD, depending upon the degree of invasion toward the MPD; neither ERCP nor the PS test were useful for detecting pancreatic cancer that occurred apart from the MPD. ERCP was also useful in the diagnosis of some cases of cancer of the body and tail of the pancreas. Because the results of the PS test can only demonstrate impairments of pancreatic secretory capacity and the results of ERCP delineate only macroscopic changes of the pancreas, a combination of ERCP and the PS test with conventional examinations is suggested for the correct diagnosis of the pancreatic cancer.

4060 TOTAL PANCREATECTOMY FOR CANCER: AN APPRAISAL OF 65 CASES. (Eng.) Ihse, I.; Lilja, P.; Arnesjo, B.; Bengmark, S. (Dept. Surgery, Univ. Lund, Lund, Sweden). *Ann. Surg.* 186(6):675-680; 1977.

Factors influencing operative mortality and morbidity, long-term survival, and metabolic sequelae were reviewed in 65 patients who underwent total pancreatectomy for cancer. The diagnoses were pancreatic cancer in 58 patients, periampullary cancer in 3, cancer of the bile duct in 2, and leiomyosarcoma of the duodenum and cystadenocarcinoma of the pancreas in 1 patient, resp. In 9 of the 58 cases with cancer of the caput, the histological examination revealed multicentricity of the tumor. In 44%, there were signs of degeneration and fibrosis in the distal part of the gland. Patient mortality in the hospital was 23% for the entire series; after 1970, it was 17%, and among patients operated by senior surgeons especially trained in pancreatic surgery, it was 12% during the whole period. The peroperative bilirubin levels seemed to influence survival time. Among 24 patients operated before 1975 in whom the operating surgeon judged the operation as radical, a 5-yr survival of 21% was recorded. In patients without detectable lymph node metastases, the mean survival time was 25 months. The postoperative exocrine insufficiency and diabetes were possible to control. A blood sugar level above 10 μM was found to significantly decrease the frequency of hypoglycemic attacks. Total pancreatectomy appears to be the surgical procedure preferred when radical treatment is selected.

4061 CARCINOMA OF THE PANCREAS AND PERIAMPULLARY REGION: A 41 YEAR EXPERIENCE. (Eng.) Coutsoftides, T.; Macdonald, J.; Shibata, H. R. (Royal Victoria Hosp., 687 Pine Ave. West, Montreal, Quebec H3A 1A1, Canada). *Ann. Surg.* 186(6):730-733; 1977.

A retrospective review of 329 cases of adenocarcinoma of the pancreas and 31 adenocarcinomas of the ampulla and common bile duct seen between 1929 and 1973 was carried out to determine which treatment procedures are most effective. The most common complaints for carcinoma of the pancreas were pain, weight loss, and jaundice in that order of frequency; jaundice was the most common complaint with periampullary lesions. The most common procedure carried out was a gastric and/or biliary bypass. Thirty-five patients underwent pancreatoduodenectomy. The survival of this latter group was longer and better than those undergoing bypass, and in 40% of patients with ampullary carcinoma a cure was effected. Patients undergoing bypass did not live longer than patients undergoing simple exploratory laparotomy. Duration of symptoms and location of tumor within the pancreas (excluding ampullary tumors) did not significantly alter the prognosis. Pancreatoduodenectomy should be undertaken whenever the tumor is deemed resectable, as this provides the only chance for cure and the best palliation.

4062 THE BIOLOGIC ACTIVITIES OF CYSTIC FIBROSIS SERUM. II. ULTRASTRUCTURAL ASPECTS OF THE EFFECT OF CYSTIC FIBROSIS SERA AND CALCIUM IONOPHORE A23187 ON RABBIT TRACHEAL EXPLANTS. (Eng.) Bogart, B. I.; Conod, E. J.; Gaerlan, P. F.; Conover, J. (New York Univ. Medical Center, New York, NY). *Pediatr. Res.* 12(1):15-24; 1978.

The effects of cystic fibrosis (CF) sera and of calcium ionophore A23187 on rabbit tracheal explants were studied ultrastructurally and cytochemically. The sera and calcium ionophore induced a swelling or an increase in the size and possibly the number of secondary lysosomes and an increase in mucus secretion in epithelium of the rabbit tracheal bioassay system. Extended incubation of the rabbit tracheal explants with either CF or control sera produced a cytotoxic effect on the tracheal epithelium, but only after the termination of the normal bioassay time period. Comparative ultrastructural study of the effect of both CF sera and calcium ionophore A23187 on the rabbit tracheal bioassay system indicated that increased membrane permeability to calcium may be important in the production of the ciliary dyskinesia response by CF serum factor(s) in the rabbit tracheal bioassay system.

4063 UNCOMMON PRESENTATION OF PANCREATIC PSEUDOCYST. (Eng.) Chawla, S. K.; Chawla, K.; Sossi, A. J.; LoPresti, P. A. (Queens Hosp. Center, 82-68 164th St., Jamaica, NY 11432). *Am. J. Gastroenterol.* 68(2):154-160; 1977.

Five cases of pancreatic pseudocyst are presented to illustrate a variety of severe and unusual complications of the disease and to afford an early and accurate analysis of the disease. The complications of pancreatic pseudocyst include infection, spontaneous rupture or fistulization, pancreatic ascites, hemorrhage due to erosion of a major vessel, jaundice due to common bile duct obstruction, hypersplenism, pleural effusion, and mediastinal extension of the cyst through the diaphragmatic hiatus. Diagnostic peritoneal aspiration of hemorrhagic fluid, rich with pancreatic enzymes (amylase, 2,055 Somogyi

U; lipase, 17.4 Cherry-Crandell U) confirms the diagnosis of ruptured pseudocyst. Diagnosis of pancreatic ascites requires a high index of suspicion, especially concerning any patient with an elevated serum amylase level and ascites. Elevated levels of ascitic fluid, amylase, lipase, and protein establish the diagnosis of pancreatic ascites. Obstructive jaundice is nearly always associated with clinical and/or laboratory evidence of either acute or chronic pancreatitis. Pancreatic pseudocyst represents an unresolved pancreatic inflammatory process, and can appear in 1 or 2 weeks following an episode of acute pancreatitis; thus, it should be suspected in a patient who is clinically improving but has persistently elevated levels of serum or urinary amylase. The pancreatic pseudocyst, during the process of expansion, may encroach on neighboring structures and even sometimes, incorporate them in the wall of the cyst. The timing of an elective operation for pseudocyst is best dictated by the clinical course of the patient.

4064 ANGIOGRAPHIC DIAGNOSIS OF ENDOCRINE TUMORS OF THE PANCREAS. (Eng.) Pistolesi, G. F.; Frasson, F.; Fugazzola, C.; Taddei, G.; Caresano, A. (Univ. Hosp., Verona, Italy). *Radiol. Clin. (Basel)* 46(6):401-421; 1977.

4065 CANCER OF THE PANCREAS. (Eng.) Howard, J. M.; Jordon, G. L., Jr. (Medical Coll. Ohio, Toledo, OH). *Curr. Probl. Cancer* 2(3):1-52; 1977.

4066 A TEN-YEAR STUDY OF CARCINOMA OF THE PANCREAS. (Eng.) Atkins, A. R.; Lindell, T. D.; Fletcher, W. S. (Univ. Oregon Health Sciences Center, 3181 S.W. Sam Jackson Park Rd., Portland, OR 97201). *Am. Surg.* 43(10):660-665; 1977.

4067 PLEURAL EFFUSION WITH PANCREATICOPLEURAL FISTULA: A CASE REPORT. (Eng.) Razzaque, M. A.; Hussain, S. A.; Hossain, Z.; Kumar, C. K. (Wayne State Univ. Sch. Medicine, Detroit, MI). *Am. J. Gastroenterol.* 68(1):84-87; 1977.

4068 CARCINOMA OF THE PANCREAS PRESENTING AS RELAPSING PANCREATITIS. (Eng.) Van Waes, L.; Van Maele, V.; Demeulenaere, L.; Lamssens, C. (St. Andrieskliniek, Kromme Walstreet 8, B-8880 Tielt, Belgium). *Am. J. Gastroenterol.* 68(1):88-90; 1977.

4069 FALSE-POSITIVE DIAGNOSES OF PANCREATIC TAIL LESIONS CAUSED BY COLON. (Eng.) Berger, M.; Smith, E. H.; Bartrum, R. J., Jr.; Holm, H. H.; Mascatello, V. (Harvard Medical Sch., 25 Shattuck St., Boston, MA 02115). *J. Clin. Ultrasound* 5(5):343-345; 1977.

4070 TRANSPLANTATION OF THE PANCREAS: ITS PRESENT STATUS AND FUTURE APLLICATION. (Eng.) Gray, B. N. (St. Vincent's Hosp., Fitzroy, Victoria 3065, Australia). *Aust. N.Z. J. Surg.* 47(2):143-149; 1977.

4071 CARCINOMA OF THE PERIAMPULLARY REGION: A REVIEW OF A PERSONAL SERIES OF 87 PATIENTS. (Eng.) Balasegaram, M. (General Hosp., Kuala Lumpur, Malaysia). *Br. J. Surg.* 63(7):532-537; 1976.

See also, 3848, 3849, 3851, 3862, 3867, 3873, 4076, 4080, 4081, 4084, 4085, 4183.

PANCREAS

Pancreatitis

4072 EARLY ASSESSMENT OF SEVERITY OF ACUTE PANCREATITIS USING PERITONEAL LAVAGE. (Eng.) Pickford, I. R.; Blackett, P. L.; McMahon, M. J. (General Infirmary, Leeds LS1 3EX, England). *Br. Med. J.* 2(6099):1377-1379; 1977.

The value of peritoneal lavage in determining the severity of acute pancreatitis was assessed in 27 patients. Peritoneal lavage using 1 liter of isotonic saline was performed as soon as possible after diagnosis of acute pancreatitis. There were no complications. Severe attacks (defined retrospectively according to the progress of the attack) were characterized by the presence of free peritoneal fluid and by dark-colored and often opalescent return fluid. The concentrations of albumin, SGOT, and total protein in the return fluid provided good discrimination ($p<0.001$ for each parameter) between severe and mild attacks, and there were also significant differences in the concentrations of amylase, urea, calcium, potassium, bilirubin, alkaline phosphatase, and the WBC count ($p<0.001$, $p<0.01$, $p<0.01$, $p<0.01$, $p<0.01$, $p<0.05$, and $p<0.02$, resp.). Lavage successfully predicted severe disease in five patients whose condition had been clinically assessed as mild.

4073 THE USE OF A NEW PROTEINASE INHIBITOR IN ACUTE PANCREATITIS. (Ger.) Kronberger, L.; Musil, H. E.; Hollerl, G.; Prexl, H. J.; Eide,

M. (Chirurgische Universitatsklinik, Auenbruggerplatz 1, A-8036 Graz, Austria). *Wien. Med. Wochenschr.* 127(16):517-521; 1977.

The therapeutic effectiveness of Pantinol, a new proteinase inhibitor, was studied in 50 patients with acute pancreatitis. Primary acute pancreatitis was diagnosed in 28 patients and postoperative acute pancreatitis in 22. In addition to the conventional therapy, the patients received i.v. infusions of Pantinol in 5% glucose or levulose solution. The daily dose (administered in 2-4 portions) was 400,000-1,500,000 U in patients with acute primary pancreatitis, and 500,000-1,000,000 U in those with postoperative pancreatitis, depending on the grade of the disease. The therapy resulted in the rapid subsidence of the symptoms and normalization of the elevated urinary amylase and leukocyte levels in all but four patients with acute primary pancreatitis. The amylase levels were consistently normal after the 10th day. Pantinol was well tolerated by the patients. The findings indicate the great value of Pantinol in the treatment of patients with acute pancreatitis.

4074 SERUM PARATHYROID HORMONE IN PANCREATITIS: A PROSPECTIVE STUDY OF 40 PATIENTS. (Fre.) Galmiche, J. P.; Mallet, E.; Colin, R.; Reumont, G.; Geffroy, Y. (Hopital Charles-Nicolle, 1, rue de Germont, F 76038 Rouen Cedex, France). *Gastroenterol. Clin. Biol.* 1(8/9):653-659; 1977.

Serum parathyroid hormone (PTH) levels were determined in 40 randomized patients with pancreatitis. Calcifying pancreatitis was diagnosed in 20 patients and noncalcifying pancreatitis in the others. Pancreatitis was the first clinical manifestation of primary hyperparathyroidism, which was recognized by a high PTH level in two patients. In the other 38 patients with pancreatitis and without primary hyperparathyroidism, the mean PTH level was not significantly different from that found in the control group (1.28 ng/ml versus 1.18 ng/ml in the controls). The PTH level found in 4 of the 38 patients exceeded the upper limit of the normal range, but primary hyperparathyroidism was ruled out on the basis of other biochemical findings. The pathogenesis of pancreatitis in hyperparathyroidism has not yet been clarified, but hypercalcemia is believed to play an important role, either by activating the pancreatic trypsinogen, or by facilitating the precipitation of calcium in the pancreas.

4075 INHIBITION OF EXAGGERATED GASTROINTESTINAL GLUCAGON RESPONSES IN CHRONIC PANCREATITIS BY SOMATOSTATIN. (Eng.) Botha, J. L.; Vinik, A. I.; Child, P. T.; Jackson, W. P. U. (Dept. Medicine, Univ. Cape Town, Cape Town, South Africa). *J. Clin. Endocrinol. Metab.* 45(6):1265-1270; 1977.

The effects of somatostatin on cross-reacting gastrointestinal glucagon-like immunoreactivity (GLI) and "pancreatic" immunoreactive glucagon (IRG) responses to p.o. glucose were studied in five patients with chronic pancreatitis and five normal controls. Glucose administration caused an exaggerated release of GLI and a slight early rise in IRG concentration in patients with chronic pancreatitis (who have impaired insulin release). The i.v. administration of somatostatin (200 µg), followed by infusion of an additional 200 µg over 2.5 hr, abolished the GLI and insulin responses, but did not change glucose tolerance. This result contrasts with the relatively minor effects of somatostatin on GLI responses in controls, where the clear deterioration in glucose tolerance may relate to inhibition of insulin release.

4076 THE FREQUENCY OF MACROAMYLASEMIA AND THE DIAGNOSTIC VALUE OF AMYLASE TO CREATININE CLEARANCE RATIO IN PATIENTS WITH ELEVATED SERUM AMYLASE ACTIVITY. (Eng.) Durr, H. K.; Bindrich, D.; Bode, J. C. (Medizinische Klinik der Universitat, D-3550 Marburg/Lahn, W. Germany). *Scand. J. Gastroenterol.* 12(6):701-705; 1977.

The frequency of macroamylasemia was studied in 190 patients with elevated serum amylase levels. The value of the amylase to creatinine clearance ratio (C_{am}/C_{cr} ratio) as a screening test for macroamylasemia was assessed in 183 patients. Macroamylasemia was found in three patients. In these patients, macroamylasemia persisted after the total activity of serum amylase had fallen to nearly normal levels. The C_{am}/C_{cr} ratios were determined 14 times in the three macroamylasemic patients. Only one of the 14 values was clearly less than 1%. C_{am}/C_{cr} ratios above 4% were found in 83 patients. In 56 of them, the diagnosis of acute pancreatitis could not be confirmed. Nineteen of 46 patients with acute pancreatitis had C_{am}/C_{cr} ratios below 4%. C_{am}/C_{cr} ratios below 1% were also found in 48 of 134 patients without macroamylasemia. It is concluded that high and low C_{am}/C_{cr} ratios are not specific for acute pancreatitis and macroamylasemia, resp., and that a normal C_{am}/C_{cr} ratio excludes neither acute pancreatitis nor macroamylasemia.

4077 CALCITONIN IN THE TREATMENT OF ACUTE PANCREATITIS. A MULTI-CENTRE DOUBLE BLIND STUDY [Abstract]. (Eng.) Goebell, H.; Ammann, R.; Akovbiantz, A.; Barth, E.; Hahnloser, P.; Herfarth, C.; *et al.* (Pancreatitis Study Group, Essen, W. Germany). *Ir. J. Med. Sci.* 146(Suppl. 1):36; 1977.

4078 A SINGLE CENTRE DOUBLE BLIND TRIAL OF TRASYLOL THERAPY IN PRIMARY ACUTE PANCREATITIS [Abstract]. (Eng.) Imrie, C. W.; Benjamin, I. S.; Ferguson, J. C.; Thompson, W. O.; McKay, A. J.; Blumgart, L. H. (Royal Infirmary, Glasgow G4 OSF, Scotland). *Ir. J. Med. Sci.* 146 (Suppl. 1):35; 1977.

4079 MUSCARINE-INDUCED EXPERIMENTAL PANCREATITIS [Abstract]. (Eng.) Murphy, J. J.; McGeeney, D. M.; FitzGerald, O.; McGeeney, K. F.

(Dept. Medicine, Therapeutics, Univ. Coll., Dublin, Ireland). *Ir. J. Med. Sci.* 146(Suppl. 1):32; 1977.

4080 A NEW PANCREATIC FUNCTIONAL EXPLORATION TEST: THE PABA TEST [Abstract]. (Eng.) Ribet, A.; Escourrou, J.; Frexinos, J.; Vaysse, N. (Service des Maladies de l'Appareil Digestif, C.H.U. de Rangueil, 31054 Toulouse Cedex, France). *Ir. J. Med. Sci.* 146(Suppl. 1):31; 1977.

4081 EXOCRINE PANCREATIC INSUFFICIENCY IN RECOVERED ACUTE PANCREATITIS AND IN ACUTE RECURRENT PANCREATITIS (AN OPEN QUESTION) [Abstract]. (Eng.) Farini, R.; Del Favero, G.; Pedrazzoli, S.; Fabris, G.; Adorati, M.; Kind, R.; *et al.* (Istituto Clinica Medica I, Universita Padova, Padova, Italy). *Ir. J. Med. Sci.* 146 (Suppl. 1):88-89; 1977.

4082 SERUM CHOLECYSTOKININ FASTING LEVELS IN CHRONIC RELAPSING PANCREATITIS [Abstract]. (Eng.) Ederle, A.; Vantini, I.; Harvey, R.; Piubello, W.; Oliver, J.; Benini, L.; *et al.* (Clinica Medica III, Policlinico, 37100 Verona, Italy). *Ir. J. Med. Sci.* 146(Suppl. 1):30; 1977.

4083 HIGH DOSAGE EFFECTIVE TRASYLOL THERAPY IN EXPERIMENTAL ACUTE PANCREATITIS [Abstract]. (Eng.) Imrie, C. W.; Mackenzie, M. (Royal Infirmary, Glasgow G4 OSF, Scotland). *Ir. J. Med. Sci.* 146 (Suppl. 1):42; 1977.

4084 GREY SCALE ULTRASONOGRAPHY IN ACUTE PANCREATITIS. A PROSPECTIVE STUDY [Abstract]. (Eng.) McKay, A. J.; Duncan, J. G.; Imrie, C. W.; O'Neill, J.; Benjamin, I. S.; Blumgart, L. H. (Royal Infirmary, Glasgow G4 OSF, Scotland). *Ir. J. Med. Sci.* 146(Suppl. 1):76-77; 1977.

4085 FREQUENCY OF EXTRAHEPATIC PORTAL HYPERTENSION (E.P.H.) IN CHRONIC PANCREATITIS (C.P.) AND ITS COMPLICATIONS [Abstract]. (Eng.) Naccarato, R.; Farini, R.; Fabris, G.; Del Favero, G.; Kind, R.; Pedrazzoli, S.; *et al.* (Istituto Clinica Medica I, Universita Padova, Padova, Italy). *Ir. J. Med. Sci.* 146(Suppl. 1):41-42; 1977.

See also, 3850, 3862, 3867, 4068.

LIVER AND BILIARY TRACT

4086 SALIVARY ANTIPYRINE KINETICS IN HEPATIC AND RENAL DISEASE AND IN PATIENTS ON ANTICONVULSANT THERAPY. (Eng.) Harman, A. W.; Penhall, R. K.; Priestly, B. G.; Frewin, D. B.; Phillips, P. J.; Clarkson, A. R. (Dept. Human Physiology and Pharmacology, Univ. Adelaide, Adelaide, South Australia 5000, Australia). *Aust. N.Z. J. Med.* 7(4):385-390; 1977.

The effects of liver disease, renal failure, and hepatic microsomal enzyme induction on the elimination kinetics of antipyrine in saliva were examined in 6 patients with chronic liver disease, 5 patients with chronic renal failure, 9 patients receiving anticonvulsant therapy, and 20 healthy controls. Antipyrine (10 mg/kg) was given p.o. to all subjects and assayed in saliva by gas-liquid chromatography. The mean antipyrine half-life from saliva in the epileptic subjects receiving anticonvulsant therapy (6 ± 0.9 hr) was significantly shorter than in the normal volunteers (10.7 ± 0.6 hr). Therapy included phenytoin and phenobarbitone, two drugs known to induce hepatic microsomal enzymes. The five subjects with chronic renal failure exhibited no significant difference in salivary antipyrine half-life (11.7 ± 1.9 hr) compared to the controls, whereas the subjects with chronic liver disease and impaired hepatic function had significantly increased half-life values (42.4 ± 10 hr). The results suggest that differences in the activity of hepatic microsomal enzymes are reflected by changes in salivary antipyrine elimination kinetics. Chronic renal failure appeared to have no effect on the function of these enzymes.

4087 SERUM IMMUNOREACTIVE PROLYL HYDROXYLASE IN LIVER DISEASE. (Eng.) Tuderman, L.; Risteli, J.; Miettinen, T. A.; Kivirikko, K. (Dept. Medical Biochemistry, Univ. Oulu, Kajaanintie 52 A, SF-90220 Oulu 22, Finland). *Eur. J. Clin. Invest.* 7(6):537-541; 1977.

The concentration of serum immunoreactive prolyl hydroxylase (SIRPH) was measured in 30 patients with chronic active hepatitis, 13 with primary biliary cirrhosis, 4 with alcoholic or idiopathic cirrhosis, and 4 with acute hepatitis, and the values were compared with those in 23 controls. Increases in SIRPH were found in all patients with liver diseases, individual values being highest in primary biliary cirrhosis in which about two-thirds of the patients had values more than 2 standard deviations above the mean value in the controls. No correlation was found between SIRPH and other tests of liver function or some routine laboratory

tests. SIRPH may reflect some hitherto unknown or unmeasured process in the diseased hepatic cells.

4088 ENDOSCOPIC RETROGRADE CHOLANGIOGRAPHY (ERC) IN NONAMEBIC LIVER ABSCESSES. (Eng.) Ascione, A.; Elias, E.; Scott, J.; Sherlock, S. (Ospedale Cardarelli-XX Divisione, Sezione Epatologia, Naples, Italy). *Am. J. Dig. Dis.* 23(1): 39-44; 1978.

Two cases of liver abscesses are reported in which the diagnosis was suggested by a combination of liver scanning, ultrasonography, arteriography, and liver biopsy and then confirmed by endoscopic retrograde cholangiography (ERC), which showed intrahepatic extravasation of contrast material from the biliary tree. A 53-yr-old man with a 1-month history of jaundice, colicky periumbilical pain, malaise, lethargy, vomiting, and diarrhea underwent a technetium-99 colloidal liver scan and gallium-67 scan, and ultrasonography, all of which showed an enlarged liver and suggested space-occupying lesions. The liver biopsy showed intensive centrilobular congestion. Benzyl-penicillin was administered in place of cotrimoxazole following demonstration of anaerobic coccus in the liver biopsy. Endoscopic retrograde cholangiopancreatography (ERCP) showed no gallstones and the diagnosis of liver abscesses was confirmed. At laparotomy, pus was drained from one of two cystic cavities in liver lobes, and many firm nodules were found. The patient recovered quickly and was healthy at 1 yr of follow-up. A 13-yr-old male student was seen with fever, malaise, vomiting, and right upper quadrant pain; he had a 17-month history of pyrexia at monthly intervals associated with vomiting and dark urine. He became jaundiced and a laparotomy was performed that showed a markedly enlarged and inflammed liver with multiple adhesions surrounding the gallbladder. No evidence of cholestasis was found in liver biopsy. Liver technetium scan showed no space-occupying lesions. Despite treatment with gentamicin and ampicillin, the patient remained pyrexial with increasing jaundice and anemia. Radiotechnetium scan and celiac arteriography of the liver showed markedly enlarged liver. Gray-scale ultrasound showed no evidence of lesions in the liver. There was no evidence of tumor. ERCP showed a dilated common bile duct and gross distortion of the intrahepatic biliary tree. During treatment with i.v. metronidazole and p.o. cotrimoxazole, the fever subsided. After 3 months, the patient was well, with normal liver function tests, and ERCP showed that the intrahepatic biliary tree was less disorganized. ERCP is a valuable method in the search for an underlying cause in nonamebic liver abscesses due to its ability to delineate clearly the details of the intrahepatic biliary tree.

4089 EPIDEMIOLOGICAL RELATIONSHIP BETWEEN STEROID HORMONES AND LIVER LESIONS. (Eng.) Mahboubi, E.; Shubik, P. (Univ. Nebraska Medical Center, 42nd and Dewey Ave., Omaha, NB 68105). *J. Toxicol. Environ. Health* 3(1/2)207-218; 1977.

The incidence of benign liver cell adenomas in female users of steriod sex hormones (oral contraceptives) is reviewed to determine the possible relationship between these drugs and the occurrence of benign liver tumors, entities once considered rare. Pathologists do not yet agree on the nomenclature of these lesions and commonly use terms such as adenoma, benign hepatoma, hepatic cell adenoma, focal nodular hyperplasia, mixed adenoma, solitary hyperplastic nodules, and hamartoma. Among 137 cases in the literature in the past 3 yr, 60 were discovered by sudden onset of symptoms, 54 by gradual onset, 15 incidentally, and 8 by unknown means. In the absence of tumor registries for these lesions, the authors used personal contact with surgeons, family physicians, and pathologists (by mail or interview) to discover 20 additional cases of liver lesions in women in Nebraska currently using oral contraceptives. Of the 20 cases, 4 were diagnosed as primary malignant liver tumors (hepatocellular adenomas) and the remainder as benign liver tumors. The four patients with hepatocellular carcinoma died at surgery or within 2-3 days thereafter; one patient with ruptured benign adenoma and one with spontaneous rupture of the liver also died. A sudden, severe onset of epigastric pain, shock, and symptoms of internal bleeding occurred in 35% of the patients, a gradual onset of pain and the presence of a palpable mass occurred in 45%, and in 20% the lesions were discovered incidentally during surgery for other causes. In 16 of the 20 cases, a mestranol combination pill had been taken. The period of pill use ranged from 3-79 months (mean, 42.3 months). These tumors occurred over the last 10 yr with incidence rates of 0.052/100,000 population in 1968 and 0.169 in 1975; however, more data must be assembled before meaningful incidence rates can be calculated. Studies of hepatomas published by the American College of Surgeons and published world wide during the last 3 years are cited that demonstrate similar results. It is suggested that more information be assembled to establish incidence rates of these liver lesions to discover the risk for oral contraceptive users, and to ascertain which hormones act independently or in combination with other factors as etiological agents of these entities.

4090 PRIMARY SARCOMA OF THE LIVER: REPORT OF A CASE WITH EXCELLENT RESPONSE TO HEPATIC ARTERY LIGATION AND INFUSION CHEMOTHERAPY. (Eng.) Tanner, A. R.; Bolton, P. M.; Powell, L. W. (Royal Brisbane Hosp., Herston Rd., Brisbane 4029, Australia). *Gastroenterology* 74(1):121-123; 1978.

A case of primary undifferentiated liver sarcoma, successfully treated with hepatic artery ligation and infusion chemotherapy, in a 66-yr-old woman is reported. The presenting symptoms included a tender enlarged liver, persistent pyrexia, weight loss, vomiting, and diarrhea. Preoperatively, the presentation was considered to be that of an abscess with associated severe constitutional symptoms requiring urgent drainage. Neither hepatic scan nor ultrasound clearly distinguished

between abscess or neoplasm. Celiac axis angiography performed before hepatic artery ligation demonstrated a solid vascular lesion consistent with a neoplasm. The patient's response to palliative treatment with hepatic artery ligation and chemotherapy with 5-fluorouracil (750 mg, 3 weeks) via the hepatic artery was excellent. This may be the first report of such a response in a sarcoma localized to the liver. This therapy may well be useful in symptomatic patients in whom partial hepatectomy is not feasible.

4091 IMMUNE COMPLEXES AND ABNORMAL LIVER FUNCTION IN HAEMOPHILIA. (Eng.) McVerry, B. A.; Voke, J.; Mohammed, I.; Dormandy, K. M.; Holborow, E. J. (Royal Free Hosp., London NW3 2QG, England). *J. Clin. Pathol.* 30(12):1142-1146; 1977.

Immunological parameters were evaluated in 55 hemophiliacs, 55% of whom had abnormal liver function tests. Abnormal ^{125}I-complement component 1q (^{125}I-C1q)-binding activity was found in the sera of 94% of the 55 patients. Sera from 66% of these patients inhibited macrophage uptake of labeled aggregated human IgG in a competitive radiobioassay. These results suggest that large molecular weight immune complexes are present in these sera. Analysis of the precipitates obtained directly from the sera by the addition of 4% polyethylene glycol showed either a mixture of IgG and IgM or IgM alone. There was poor correlation between the radiobioassay results and the C1q-binding activities in the whole group of 55 patients, suggesting a heterogeneous population of complexes. Nevertheless, a significant correlation (r=0.75) was found between C1q-binding activities and the radiobioassay results in seven patients with antibodies to factor VIII, suggesting a homogeneous population of complexes. There was poor correlation between the level of immune complexes and the amount of replacement therapy that the patient had received in the previous 6 months and between the abnormal liver function test results and the C1q-binding activities and radiobioassay results. Only two patients had clinical evidence of liver disease.

4092 GIANT HEMANGIOMATOSIS OF THE LIVER IN INFANCY. (Eng.) Othersen, H. B.; Watanatittan, S. (Medical Univ. South Carolina, 80 Barre St., Charleston, SC 29401). *Am. Surg.* 44(1):20-25; 1978.

Two case reports of hepatic hemangiomatosis in infancy are presented to clarify the definition of this entity, to review its therapy by corticosteroid administration and hepatic artery ligation, and to compare a successful outcome with an unsuccessful one. A liver scan on a 2-month-old girl with increasing abdominal girth, anemia, and edema of lower extremities showed a markedly enlarged liver with little functioning tissue. Retrograde aortogram revealed extensive neovasculature throughout the liver suggestive of diffuse hemangiomatosis. Prednisolone therapy (30 mg i.v. followed by 15 mg every other day) day) was unsuccessful. During exploratory laparotomy, diffuse involvement of the liver by large, cavernous vascular spaces was found, and the right hepatic artery was ligated. Prednisolone treatment was continued and irradiation (total dose, 350 rads over 8 days) was given, but the signs of disseminated intravascular coagulopathy developed with a platelet count of 30,000. The patient died 12 hr following a second operation, during which the proper hepatic artery and the right branch of the portal vein were ligated. A 2-month-old girl was seen with rapidly progressing abdominal distention and a firm palpable mass. X-ray films showed a large liver, while retrograde aortogram visualized a vascular lesion involving the entire liver. The proper hepatic artery was ligated; at this time, the liver was diffusely enlarged with cavernous vascular spaces. Over a period of 2 months after surgery, the abdominal girth increased 5 cm, and liver scan indicated increase in the filling defects with revascularization of the hemangioma. Prednisone (15 mg p.o.) was given every other day. Over 5 months, the abdominal girth increased 3 cm, then decreased slightly, and stabilized. Differential diagnosis of hemangiomatosis is discussed. It is suggested that, in cases of diagnosed hemangiomatosis of the liver, prednisone should be administered early in large doses (up to 40 mg daily for a few days if the abdomen enlarges rapidly). If there is no response after about 2 weeks, operative ligation of the proper hepatic artery should be performed. Radiotherapy is not recommended.

4093 ULTRASTRUCTURAL OBSERVATIONS ON KUPFFER CELLS IN INTRAHEPATIC CHOLESTATIC JAUNDICE. (Eng.) Djaldetti, M.; Zahav, L. H.; Gafter, U.; Mandel, E. M. (Hasharon Hosp., Petah-Tiqva, Israel). *Arch. Pathol. Lab. Med.* 102(1):49-51; 1978.

Ultrastructural findings in a liver biopsy specimen from a patient with intrahepatic cholestatic jaundice are reported. Marked dilation of the bile capillaries, disappearance of the microvilli, and thickened ectoplasm were observed. The unusual finding was a great increase in the number of Kupffer cells that contained masses of electron-dense material, most probably bile. A second examination of the liver, performed 1 month later when the liver test results had returned to normal, showed only remnants of the Kupffer cells. The Kupffer cells may play a role in the clearance of the blood from the bile pigments.

4094 UNUSUAL OBLITERATIVE DISEASE OF THE HEPATIC VEINS IN AN INFANT. (Eng.) Burkhardt, A.; Kloppel, G. (Institut fur Pathologie der Universitat Hamburg, Martinistr. 52, UKE, D-2000 Hamburg 20, W. Germany). *Virchows Arch. [Pathol. Anat.]* 375(3):225-232; 1977.

The case of a 3-month-old boy with fatal congenital leukemia treated with cytostatic drugs (cytosine-arabinoside, 185 mg; vincristine, 0.8 mg) who developed hepatic fibrosis with obliterative lesions of the small hepatic veins is presented. The vas-

cular changes were characterized by an unusual, hitherto unreported angiomatoid proliferation of the endothelium. The process is compared with the more common subendothelial fibrous type of "veno-occlusive disease." The etiology may involve a secondary reaction of the endothelium to a cytostatic-induced lesion with hepatic fibrosis.

4095 'PSEUDOCIRRHOSIS' IN HEREDITARY HAEMORRHAGIC TELANGIECTASIA. (Eng.) Cooney, T.; Sweeney, E. C.; Coll, R.; Greally, M. (Sch. Pathology, Trinity Coll., Dublin, Ireland). *J. Clin. Pathol.* 30(12):1134-1141; 1977.

The case of a 68-yr-old woman with hereditary hemorrhagic telangiectasia (HHT) who developed telangiectasia-associated hepatic fibrosis is described. The patient died of oat-cell carcinoma of the lung. In addition to the structural alterations that have been described previously in HHT, the liver exhibited focal midlobular hepatocyte necrosis and tumor metastases. The hepatocyte hyperplasia in this patient may have been related to high-dose estrogen therapy for HHT.

4096 THE MYTHOLOGY OF HEPATIC TRAUMA--OR BABEL REVISITED. (Eng.) Walt, A. J. (Wayne State Univ. Sch. Medicine, 540 East Canfield Ave., Detroit, MI 48201). *Am. J. Surg.* 135(1):12-18; 1978.

Selected aspects of hepatic injury are reviewed on the basis of case reports for 1961-1976 of 1,404 patients with liver injuries who underwent surgery to clarify the surgical problems encountered in this entity and to dispel a number of common but erroneous ideas concerning this subject. The causes of liver injuries were gunshots (55.3%), stabbing (34.2%), and blunt instruments (10.5%). Isolated hepatic injuries were rare (e.g., <10% in patients with blunt injury); mortality was proportional to the number of organs injured, and exceeded 50% when four organs were damaged. The chest, extremities, head, vascular structures, intestines, and spleen (in descending order of frequency) were the sites of associated injuries, which were often multiple. Surgical methods for treatment are quite varied and are tabulated. Hemorrhage was the major cause of death (62.5% of deaths), followed by sepsis and/or respiratory failure (15%), and heart injuries (15%). In just more than 50% of patients, bleeding from the liver had stopped spontaneously before laparotomy. Manual compression, precise ligation of small arteries or veins, and suturing are also able to produce hemostasis when appropriately applied. Hemobilia was observed in only one case. If bleeding was persistent, apparently arterial, and not associated with a smashed lobe requiring resection, hepatic artery ligation merits consideration. The long-standing aversion to this procedure is challenged, showing that hepatic failure is rare and that sepsis is not an inevitable outcome following this procedure. Indications for hepatic artery ligation are given, and alternatives discussed. Resectional debridement can achieve excellent results, microcrystalline collagen applied to a raw surface to aid in hemostasis has not been sufficiently evaluated, true lobectomy has fallen into deserved disrepute except in well-selected instances, and the gauze pack has clearly useful applications. The cannulation of retrohepatic inferior vena cava performed in nine patients was unsuccessful, but it is likely that the type of patient selected for this procedure markedly influences the outcome. A prospective, randomized study of the use of the T-tube for drainage of the common and bile ducts indicates that this procedure should be avoided except in selected cases in which the extrahepatic ducts have themselves been injured. The experience collected here indicates the necessity of critical evaluation of all ideas and procedures in any scientific field.

4097 SELECTIVITY IN THE MANAGEMENT OF HEPATIC TRAUMA. (Eng.) Flint, L. M.; Mays, E. T.; Aaron, W. S.; Fulton, R. L.; Polk, H. C., Jr. (Univ. Louisville Sch. Medicine, Health Sciences Center, Louisville, KY). *Trans. South. Surg. Assoc.* 88:121-126; 1977.

A retrospective review of 178 consecutive patients who sustained hepatic injuries confirmed that selective hepatic artery ligation (SHAL) is an efficient means of definitive hemostasis. Hepatic wounds were managed by drainage, suture, resectional debridement, SHAL, and formal lobectomy, or combinations thereof. As the injury grade increased, SHAL was employed more frequently. Hepatic artery interruption was successful in controlling arterial bleeding from the hepatic parenchyma in all patients in whom it was employed. The operative records of 59 patients undergoing SHAL disclosed that in 82% the decision to employ SHAL followed the failure of conventional modalities to control arterial bleeding. The mortality among 59 patients who underwent SHAL was 31% compared to an overall mortality for all other treatment modalities of 22%; this difference was not statistically significant. The incidence of perihepatic sepsis following hepatic artery interruption was also not significantly increased when compared with other modalities. Overall, the most frequent complications after severe hepatic trauma were bleeding from extrahepatic sites and sepsis, which occurred in 12 and 10 patients, resp.

4098 ARTHROPATHY IN WILSON'S DISEASE. (Fre.) Boudin, G.; Pepin, B.; Hubault, A.; Goldstein, B.; Lidy, C. (Hopital Lariboisiere, 2, rue Ambroise-Pare, F 75475 Paris Cedex 10, France). *Ann. Med. Interne (Paris)* 128(11):853-856; 1977.

Wilson's disease with neurological symptoms and arthropathy was diagnosed in a 30-yr-old man in 1956. D-penicillamine treatment (1-1.5 g/day) was begun in 1960 and continued to the present; it produced considerable regression of the neurological signs after several months, disappearance of Kayser-Fleischer rings after 4 yr of treatment, and complete compensation of the liver status. Gradual progression of the articular symptoms necessitated

the insertion of a MacKee prosthesis in the knee in 1968. Investigation of a surgical specimen revealed condensation of the bone surfaces of the joint; para-articular calcification at the points of insertion of the capsula, ligaments and sinews; and a hypervascularized, angiomatous synovial membrane. The physiopathology of arthropathy in Wilson's disease is unknown. There seems to be no correlation between the intensity of the neurologic, hepatic, and renal syndromes and the arthropathy.

4099 ANGIOGRAPHIC STUDY OF THE VASCULARIZATION OF PRIMARY MALIGNANT LIVER TUMORS: HISTOLOGICAL CORRELATION. (Spa.) Pinchuk, L.; Zeilicoff, R.; Falcon, O.; Kesner, L.; Buquet, J.; Figueroa, M.; Cimino, C. (No affiliation given.). *Acta Gastroenterol. Latinoam.* 7(1):23-31; 1977.

4100 BENIGN LIVER TUMORS IN CHILDREN. (Fre.) Djaja, M.; Bumbic, S.; Lazovic, M. (Pediatric Surgery Clinic, Univ. Belgrade, Belgrade, Yugoslavia). *Ann. Chir. Infant.* 18(1):53-58; 1977.

4101 CURRENT ASPECTS OF PRIMARY LIVER CANCER IN ADULTS (PART IV): PATHOLOGIC ANATOMY. (Spa.) Herrerias, J. M.; Velasco, A.; Matilla, A.; Garrido, M. (Hospital Clinico Universitario de Sevilla, Seville, Spain). *Rev. Esp. Enferm. Apar. Dig.* 49(6):789-800; 1977.

4102 CURRENT ASPECTS OF PRIMARY LIVER CANCER (PART V): PROGNOSIS AND TREATMENT. (Spa.) Herrerias Gutierrez, J. M.; Jimenez Saenz, M.; Garrido Peralta, M. (Hospital Clinico Universitario de Sevilla, Sevilla, Spain). *Rev. Esp. Enferm. Apar. Dig.* 50(1):99-108; 1977.

4103 PRIMARY LIVER CANCER REVEALED BY SPONTANEOUS HEMOPERITONEUM: REPORT OF THREE CASES. (Fre.) Tissot, E.; Weissbrod, R.; Pasquier, P.; Brun, M.; Baudet, B.; Francillon, J. (Hopital Edouard-Herriot, 69374 Lyon Cedex 2, France). *Lyon Chir.* 73(2):146-148; 1977.

4104 OSMOTIC AND MECHANICAL RESISTANCE OF ERYTHROCYTES IN CHRONIC LIVER DISEASES. (Ger.) Konrad, H.; Brust, B.; Oldenburg, G. (Klinik fur Innere Medizin des Bereichs Medizin der Wilhelm-Pieck Universitat, Ernst-Heydemann-Strasse, DDR-25 Rostock, E. Germany). *Z. Gesamte Inn. Med.* 32(6):143-147; 1977.

4105 POST-HEPARIN LIPOLYTIC EFFECT IN DIFFUSE LIVER DISEASES. (Spa.) Romero, R.; Masdeu, S.; Frison, J. C.; Ras, M. R.; Rubies-Prat, J.; Bacardi, R. (Ciudad Sanitaria de la Seguridad Social, Universidad Autonoma, Barcelona, Spain). *Rev. Esp. Enferm. Apar. Dig.* 50(4):439-444; 1977.

4106 ABNORMAL HEPATIC ARTERY ORIGINATING FROM THE SUPERIOR MESENTERIC ARTERY AND DUODENOPANCREATECTOMY. (Fre.) Pouyet, M.; Treboux, M. (Clinique Claude-Bernard, 69600 Oullins, France). *Lyon Chir.* 73(2):152-155; 1977.

4107 ECHOGRAPHY IN THE ASSESSMENT OF LIVER CHANGES IN CHILDREN WITH VARIOUS DISEASES. (Rus.) Oskolkova, M. K.; Dvoryakovsky, I. V. (Scientific Res. Inst. Pediatrics, USSR Acad. Medical Sciences, Moscow, USSR). *Vopr. Okhr. Materin. Det.* 22(2):12-17; 1977.

4108 LAPAROSCOPY WITH MAGNIFYING OPTIC: A METHOD FOR THE MACROSCOPIC STUDY OF LIVER PHYSIOPATHOLOGY. (Spa.) Aguilar Reina, J. (Ciudad Sanitaria "Virgen del Rocio," Seguridad Social, Sevilla, Spain). *Rev. Esp. Enferm. Apar. Dig.* 50 (1):23-30; 1977.

4109 COMPARISON OF ENDOSCOPIC BIOPSY AND SCINTISCANS IN LIVER DISEASES. (Ger.) Selmair, H.; Georgi, P.; Sinn, H.; Junker, H. (Klinik Wartenberg, D-8059 Wartenberg, W. Germany). *Munch. Med. Wochenschr.* 119(29/30):971-974; 1977.

4110 DIAGNOSTIC VALUE OF ISOENZYMES IN LIVER DISEASES. (Ger.) Graubaum, H. J.; Wagenknecht, C.; Schneider, G.; Schimmelpfennig, W.; Klimmt, G.; Baumgarten, R.; *et al.* (II. Medizinischen Klinik des Bereichs Medizin [Charite] Humboldt-Universitat, Hessische Str. 3/4, DDR-104, Berlin, E. Germany). *Dtsch. Gesundheitsw.* 32(24): 1119-1124; 1977.

4111 PURIFICATION OF THE LIVER WITH HETEROLOGUS LIVER. PHYSIOLOGICAL PRINCIPLES AND PRELIMINARY CLINICAL EXPERIENCE. (Ita.) Motta, G. (Istituto di Patologia Chirurgica dell' Universita di Genova, Genova, Italy). *Minerva Gastroenterol.* 23(1):49; 1977.

4112 PLASMA LIGANDIN: MEASUREMENTS IN PATIENTS WITH LIVER DISEASE AND IN ASYMPTOMATIC HBsAg BLOOD DONORS [Abstract]. (Eng.) Bass, N. M.; Kirsch, R. E.; Miller, D. J.; Niewmeyer, J.; Williams, A.; Titmuss, S.; *et al.* (Univ. Cape Town/MRC Liver Res. Group, Cape Town, South Africa). *Gastroenterology* 73(5):1212; 1977.

4113 PERIPHERAL MACROPHAGE FUNCTION IN PATIENTS WITH CHRONIC LIVER DISEASE [Abstract]. (Eng.) Triger, D. R.; Kingham, J. G. C.; Lloyd, R. S.; Wright, R. (Dept. Medicine, Southampton Univ., Southampton, England). *Digestion* 16(4):365; 1977.

4114 HEMODIALYSIS WITH HIGH PERMEABILITY MEMBRANE IN FULMINANT HEPATIC FAILURE [Abstract]. (Eng.) Opolon, P.; Nusinovici, V.; Denis, J.; Darnis, F. (C.H.U. Saint-Antoine, Paris, France). *Digestion* 16(4):363-364; 1977.

4115 PLASMA AMINO ACID PATTERNS IN LIVER DISEASE [Abstract]. (Eng.) Morgan, M. Y.; Milsom, J. P.; Sherlock, S. (Royal Free Hosp., Hampstead, London, England). *Digestion* 16(4):364; 1977.

See also, 3642, 3729, 3804, 3844, 3845, 3846, 3850, 3852, 3853, 3854, 3855, 3856, 3857, 3870, 3871, 3878, 3887, 3894, 3895, 3900, 3903, 3914, 3962, 3997, 4126, 4149, 4160, 4163, 4164, 4165, 4168, 4180, 4181, 4197, 4199, 4267, 4268, 4269, 4270, 4271, 4272, 4273, 4279.

LIVER AND BILIARY TRACT

Hyperbilirubinemic States

4116 PHENOBARBITAL IN PROPHYLAXIS OF NEONATAL JAUNDICE: A CONTROL TRIAL OF TWO REGIMENS. (Eng.) Salle, B.; Pasquoer, P.; Desebbe, Cl.; Rouzioux, J. M.; Barouty, B. (Hopital Edouard Herriot, Place d'Arsonval, F-69374 Lyon, France). *Helv. Paediatr. Acta* 32(3):221-226; 1977.

The effect of two different dose schedules of phenobarbital on serum bilirubin in premature and full-term newborn infants was compared to determine the minimal period of drug administration required for the prophylaxis of neonatal jaundice. Single i.m. injections of 10 mg/kg of phenobarbital were given to 155 infants before the 12th hr of life; 111 infants each received an i.m. injection of 10 mg/kg of phenobarbital before the 12th hr of life plus two additional 10 mg/kg p.o. doses on the 2nd and 3rd days of life. Serum bilirubin levels measured between the 2nd and 6th days of life were slightly higher in infants receiving the single i.m. dose of the drug than in infants receiving the three-dose regimen; however, the difference was not statistically significant, except on the 3rd day of life ($p<0.01$). Measurements of the blood phenobarbital level on the 4th day of life showed that the mean blood barbiturate level was significantly lower in infants receiving the single i.m. dose (10.61 ± 5.69 mg/100 ml) than in infants on the multiple-dose regimen (22.51 ± 10.61 mg/100 ml, $p<0.001$). There was no significant relationship between the serum bilirubin peak and the blood barbiturate level on the 4th day. In infants weighing between 1,501 and 2,000 g, for example, the mean serum bilirubin levels on the 4th day of life were 10.02 ± 2.37 mg/100 ml in those who received a single phenobarbital dose and 9.78 ± 4.72 mg/100 ml in those who received three doses of the drug. It is concluded that the single injection has the same effect as the prolonged administration, provided it is given within 12 hr after birth.

4117 OBSTRUCTIVE JAUNDICE DUE TO A CHLORINATED HYDROCARBON IN BREAST MILK. (Eng.) Bagnell, P. C.; Ellenberger, H. A. (Izaak Walton Killam Hosp. Children, P.O. Box 3070, Halifax, Nova Scotia B3J 3G9, Canada). *Can. Med. Assoc. J.* 117(9):1047-1048; 1977.

The case is presented of a 6-week-old breast-fed infant with obstructive jaundice and hepatomegaly due to the presence of the dry-cleaning solvent, tetrachloroethylene, in the mother's milk. When breast feeding was discontinued, rapid clinical and biochemical improvement followed. The child grew normally and had normal liver function during 2 yr of follow-up.

4118 DIAGNOSIS OF FUNCTIONAL GILBERT TYPE HYPERBILIRUBINEMIA IN CHILDREN. (Rus.) Syrieva, T. N.; Spasibko, A. M.; Pisarev, A. G.; Fedotov, V. V. (Dept. Infectious Childhood Diseases, N. I. Pirogov Second Moscow Medical Inst., Moscow, USSR). *Vopr. Okhr. Materin. Det.* 22(2):17-20; 1977.

LIVER AND BILIARY TRACT

Nonviral Hepatitis and Hepatic Injury

4119 ADVERSE DRUG REACTIONS INVOLVING THE LIVER: PROBABLE MECHANISMS. (Eng.) Schaffner, F.; Popper, H. (No affiliation given). *Mt. Sinai J. Med.* 44(6):813-820; 1977.

Metabolic and immune aspects of probable mechanisms of adverse hepatic drug reactions, conventionally separated into predictable and nonpredictable ones, are discussed. The former are dose-dependent, usu-

ally have a short latent period, and can be reproduced in animals. The latter are usually dose-independent, have a prolonged latent period, are only exceptionally produced in animals, are rare in children, and occur in only a few of the persons exposed. Drugs influence the cytoskeletal structure of hepatic cells in many ways altering both internal composition and external cell surfaces, which can affect cellular functions. On the other hand, the exposure of some previously hidden membrane proteins or the alteration of membrane proteins by drugs or their metabolites may induce humoral antibody formation, as well as a cell-mediated immune response. The immunologic reaction initiated by drugs and eventually causing hepatocellular injury may develop rapidly within two weeks after drug exposure (e.g., halothane hepatitis) or be delayed and appear slowly after months of therapy (e.g., chronic hepatitis from isoniazid, oxyphenisatin, methyldopa, or even aspirin). Liver injury can be caused by drugs (e.g., polychlorinated biphenyls) acting on cytochromes in the system of drug metabolizing enzymes. Intermediary drug metabolites can also act as toxic or carcinogenic agents. Each drug or metabolite appears to bind preferentially to certain types of macromolecules and probably at specific sites (e.g., binding to DNA initiates carcinogenesis). Toxic intermediates may injure the vascular endothelium leading to veno-occlusive disease (urethane) or the Budd-Chiari syndrome (oral contraceptives). Some drugs (e.g., chloropromazine) and their metabolites probably interfere directly with bile secretion, causing cholestasis. The multiplicity of drug effects makes prevention of adverse drug reactions in the liver extremely difficult. Thus, newer pharmacological and immunological observations confirm the accepted classification of adverse hepatic reactions as (1) predictable toxicities, (2) nonpredictable hepatic reactions, and (3) nonpredictable cholestatic reactions and reveal that they have definable mechanisms. These three reactions may be combined in variable proportions in individual cases, and one drug may elicit different mechanisms, but one reaction will predominate with each drug at one time point in a case.

4120 APRINDINE-INDUCED LIVER INJURY. (Eng.) Elewaut, A.; Van Durme, J. P.; Goethals, L.; Kauffman, J. M.; Mussche, M.; Elinck, W.; *et al.* (Akademisch Ziekenhuis, De Pintelaan 135, B-9000, Gent, Belgium). *Acta Gastroenterol. Belg.* 40(5/6): 236-243; 1977.

Five cases of hepatotoxicity due to the administration of the antidysrhythmic agent aprindine (100 mg/day) are reported. In all five patients, the adverse reaction appeared after a rather brief latent period (1-6 weeks). There were no other manifestations of hypersensitivity such as fever, rash, arthralgia, or eosinophilia. There were few constitutional symptoms, but in two patients severe cholestatic jaundice appeared within 2-3 weeks after initiation of the drug. After withdrawal of the drug, jaundice persisted for many weeks, but the patients recovered completely. There additional patients presented a moderate form of hepatitis, with concomitant elevations of serum amylase and lipase levels in two of them, suggesting a concomitant toxic pancreatitis. Readministration of aprindine for 3 days to these three patients was soon followed by a marked increase in the levels of serum transaminases, thus confirming the offending role of aprindine. It is suggested that the toxicity of aprindine is probably based on an idiosyncrasy of the patient.

4121 HEPATIC TOXICITY ASSOCIATED WITH GOLD THERAPY. (Eng.) Favreau, M.; Tannenbaum, H.; Lough, J. (Montreal General Hosp., Rm. 602 L.H., 1650 Cedar Ave., Montreal, Quebec H3G 1A4, Canada). *Ann. Intern. Med.* 87(6):717-719; 1977.

The clinical, biochemical, and histologic features of three patients who developed cholestatic jaundice after the initiation of chrysotherapy for rheumatoid arthritis are described. Gold sodium thiomalate had been administered in dosages of 37.5, 60, and 110 mg before the onset of jaundice. Liver function studies indicated a cholestatic jaundice in all subjects. One patient underwent exploratory laparotomy because of progressive jaundice. Liver biopsy was done in two patients. In one patient, significant bile stasis and thrombi were seen in the biliary tree. In another patient, liver biopsy showed ballooning of hepatocytes with minimal cholestasis. All patients recovered spontaneously. Awareness of this rare complication may prevent unnecessary diagnostic and surgical procedures in patients with rheumatoid arthritis who may develop jaundice while receiving chrysotherapy.

4122 HALOPERIDOL-INDUCED LIVER DISEASE. (Eng.) Fuller, C. M.; Yassinger, S.; Donlon, P.; Imperato, T. J.; Ruebner, B. (Univ. California, Davis, Sch. Medicine, Davis, CA). *West. J. Med.* 127(6):515-518; 1977.

The cases of two schizophrenic women in whom liver dysfunction developed during therapy with haloperidol are described. The dosages used were within the range recommended for severely disturbed psychiatric patients (40 mg/day in the first patient, 20-25 mg/day in the second). In the first patient, a generalized hypersensitivity reaction developed; the other patient presented with painless jaundice. Biochemically, both patients showed evidence of mild hepatocellular disease and cholestasis. In neither patient was evidence of extrahepatic biliary obstruction found. Liver biopsy in the first patient showed evidence of a hypersensitivity reaction, with some hepatocellular necrosis, but predominant cholestasis. In the second patient, only cholestasis was seen. Haloperidol is felt to be etiologically related to the liver disease seen in these two patients.

4123 SPECTRUM OF METHYLDOPA LIVER INJURY. (Eng.) Thomas, E.; Rosenthal, W. S.; Zapiach, L.; Micci, D. (New York Medical Coll., 1249 Fifth Ave., New York, NY 10029). *Am. J. Gastroenterol.* 68(2):125-133; 1977.

The occurrence of liver injury in seven patients receiving alpha methyldopa for hypertension is reported. All patients presented with symptoms indistinguishable from viral hepatitis, including jaundice and liver enlargement. Histological changes ranged from those consistent with acute hepatitis to those of chronic active hepatitis and subacute hepatic necrosis. On biopsy, the liver of one patient with subacute hepatic necrosis showed severe centrilobular and midzonal injury with a marked inflammatory response consisting of immunocytes, multinucleated cells, rosette formation, and the edge of an area of collapse. This patient, despite corticosteroid administration and supportive measures, rapidly progressed to hepatic failure and died. The autopsy revealed postnecrotic cirrhosis. The architecture of the liver at autopsy was disrupted by extensive fibrosis with nodule formation. There was also marked ductular regeneration. The parenchyma demonstrated both fine and large droplet fatty infiltration, continued liver cell injury, and some bizarre-looking parenchymal cells. Bile extravasates were visible within the fibrous scar. Inadvertent rechallenge with alpha methyldopa after recovery resulted in a dramatic recurrence of symptoms in one patient, indicating that some type of hypersensitivity phenomenon is involved. This finding is supported by the development of autoimmune phenomena, which were observed in two of the patients.

4124 FULMINANT HEPATITIS IN PATIENTS TREATED WITH ISONIAZID AND RIFAMYCIN. A POSSIBLE CONSEQUENCE OF ISONIAZID HEPATOTOXICITY ENHANCED BY ENZYME INDUCTION [Abstract]. (Fre.) Pessayre, D.; Degott, C.; Nouel, O.; Migeut, J. P.; Rueff, B.; Benhamou, J. P. (INSERM, Hopital Beaujon, Clichy, France). *Gastroenterol. Clin. Biol.* 1(5):489; 1977.

4125 OBTUSE LIVER TRAUMA: OPERATED AND NON-OPERATED PATIENTS WITH HEPATIC INJURY. 16 YEARS EXPERIENCE. (Ger.) Hoffmann, R.; Oesch, I.; Muller, H. P.; Nothiger, F. (Kantonsspital, CH-5001 Aarau, Switzerland). *Helv. Chir. Acta* 44(1/2):93-96; 1977.

See also, 3732, 3736, 3821, 3844, 4277.

LIVER AND BILIARY TRACT

Acute Viral Hepatitis

4126 LIVER DYSFUNCTION IN PATIENTS WITH HEMOPHILIA. (Eng.) Hilgartner, M. W.; Giardina, P. (New York Hosp.-Cornell Medical Center, 525 East 68th St., New York, NY 10021). *Scand. J. Haematol.* Suppl. 30:6-10; 1977.

The incidence of post-transfusion hepatitis and liver dysfunction was determined in patients with classical hemophilia who received episodic and/or prophylactic factor VIII concentrate. Of 54 patients, 42.5% had persistent biochemical evidence of liver dysfunction with elevated SGOT and SGPT; 3.8% have persistent hepatitis B surface (HBs) antigenicity and 90% have antibodies to hepatitis B surface antigen (HBsAg). The results were the same for those who were treated episodically and received an average of 153 U of factor VIII weekly as for those treated prophylactically who received an average of 686 U factor VIII weekly. The incidence of clinical and/or subclinical disease is unaffected by the transfusion regimen or the amount of concentrate used. The necessity for close follow-up is emphasized for the determination of chronic liver disease and its further therapy.

4127 VIRAL HEPATITIS: ENZYME ASSAYS AND SEROLOGIC PROCEDURES IN THE STUDY OF AN EPIDEMIC. (Eng.) Rakela, J.; Nugent, E.; Mosley, J. W. (Univ. Southern California Sch. Medicine, 2826 South Hope St., Los Angeles, CA 90007). *Am. J. Epidemiol.* 106(6):493-501; 1977.

An epidemic of viral hepatitis in a residence for multiply handicapped children, recognized very early in its course, was investigated prospectively to permit comparison of enzymatic and serologic tests. Thirty-three residents of the institution and 46 full- and part-time employees were studied by the immune adherence hemagglutination procedure for antibody (anti-HAV) to hepatitis A virus (HAV). Of these, 31 residents and 37 staff members were susceptible at the beginning of the epidemic. Nineteen and six, resp., had anti-HAV seroconversion, indicating HAV infection. Thus, 12 children and 31 staff members of presumed susceptibles did not have serologic evidence of infection. The subclinical/clinical ratio for the children was 1.1:1; for personnel, it was 1:1. Serum alanine aminotransferase (ALT) levels compatible with viral hepa-

titis occurred in 21 persons who had anti-HAV seroconversion; conversely, there were 10 persons who had ALT abnormality without detectable anti-HAV in late specimens among the total of 68 susceptibles. There was no evidence the latter could be attributed to hepatitis B virus infection; therefore, they may represent the endemic occurrence of non-A, non-B agent(s).

4128 HEPATITIS TYPE B: EPIDEMIOLOGY OF NON-PARENTERAL INFECTION. (Eng.) Pal, S. R.; Clements, C.; Ayyagari, A.; Datta, D. V.; Choudhury, S.; Chhuttani, P. N. (Postgraduate Inst. Medical Education and Res., Chandigarh-160012, India). *Bull. Postgrad. Inst. Med. Education Res. Chandigarh* 11(1):35-42; 1977.

The observation of a monthly variation of the proportion of hepatitis B surface antigen (HBsAg)-positive cases of acute hepatitis in and around Chandigarh, northern India, was investigated by studying the correlation between hepatitis cases and average rainfall, maximum temperature, mosquito density, and the frequency of gastroenteritis. A high proportion of positive cases was noticed in the months of July (13.4%), August (19.5%), and September (18.3%). No significant correlation was found between the proportion of positive cases in the disease month and the mosquito density, rainfall, or temperature at the supposed month of hepatitis B infection. A direct linear relationship was established between the proportion of HBsAg-positive hepatitis cases during the month in which the symptoms occurred and that of gastroenteritis in the supposed month of infection (i.e., assuming a 3-month incubation period).

4129 A LONGITUDINAL STUDY ON THE OCCURRENCE OF AUTOANTIBODIES IN THE COURSE OF ACUTE HEPATITIS B. (Eng.) Niermeijer, P.; Gips, C. H.; Verkerk, S.; Snijder, J. A. M. (Majella Hosp., Bussum, Netherlands). *Acta Hepatogastroenterol.* 24(5): 326-333; 1977.

The incidence, titers, and fluorescence patterns of auto-antibodies were studied in a prospective, longitudinal study of 38 patients with acute hepatitis B (AHB) to correlate the results with clinical and biochemical findings in these patients. Five patients were followed for 6-25 weeks after the maximal SGPT level was observed, while 33 were followed for 4-7 yr. Antibodies to nuclei, bile canaliculi, mitochondria, microsomes, or parietal cells were not detected in any of the 354 serum samples. Smooth muscle antibody (SMA) was present in 117 samples from 23 patients, disappeared (1-14 weeks after first detection) from the sera of the patients that subsequently recovered, remained present for at least 4 yr in the one patient with persistent hepatitis B surface antigenemia, and, when present, was always positive at the time of the SGPT peak. Maximal SMA titers were 1:10 (11 patients), 1:50 (9), 1:200 (2), and 1:400 (1). SMA titers higher than 1:50 began from -2 to +3 weeks and ended from 0 to 5 weeks after the SGPT peak. The sera of 6 patients exhibited fluorescence in smooth muscle cells only; in 17 others, fluorescence was also seen around renal tubules, in glomeruli, in hepatocytes, and in gastric mucosa in varying combinations. The type of fluorescence pattern did not correlate with titer height. There was no correlation between the presence of SMA and age, sex, extrahepatic symptoms, height of peak values for SGPT, bilirubin level, alkaline phosphatase level, or ESR. Patients with SMA $\geq$1:50 had their gammaglobulin peak nearly simultaneously with the SGPT peak ($p=0.02$), and their thymol turbidity (TT) peak was 25 U or higher, whereas 9/10 patients with SMA titer of 1:10 and the 9 patients who were SMA-negative had a TT peak <25 U ($p<0.0001$). Sera from one patient whose SMA was 1:10 produced a coarse granular fluorescence in the proximal renal tubules 1 and 2 weeks after the SGPT peak. This autoantibody assessment adds new features to the clinical and biochemical picture of the "median patient" with AHB.

4130 HEPATITIS B SURFACE ANTIGEN (HBsAg) AND ANTIBODY TO HBsAg: PREVALENCE IN HOMOSEXUAL AND HETEROSEXUAL MEN. (Eng.) Dietzman, D. E.; Harnisch, J. P.; Ray, C. G.; Alexander, E. R.; Holmes, K. K. (Dept. Pediatrics, Univ. Washington, Seattle, WA 93114). *JAMA* 238(24):2625-2626; 1977.

The prevalence of serum hepatitis B surface antigen (HBsAg) and antibody to HBsAg (anti-HBs) was compared in 144 homosexual men, 111 heterosexual men with urethritis, and 111 healthy men not questioned about their sexual behavior. HBsAg and anti-HBs were present in 5.6% and 34%, resp., of the homosexual men. The prevalence rates were only 0.9% and 3.6%, resp., in the heterosexuals with nongonococcal urethritis, and also 0.9% and 3.6% in the healthy men. Thus, previous exposure to hepatitis B virus (HBV) was estimated to be 8.8 times greater for homosexual men than for heterosexual men. All four HBsAg-positive sera from homosexual men were subtyped as "*ad*," whereas subtype "*ay*" is preponderant in i.v. drug abusers. Future public health measures to control HBV infection should address the prevention of sexually transmitted HBV infection among homosexual men.

4131 SEROEPIDEMIOLOGICAL INVESTIGATION OF PATIENTS AND FAMILY CONTACTS IN AN EPIDEMIC OF HEPATITIS A. (Eng.) Frosner, G. G.; Overby, L. R.; Flehmig, B.; Gerth, H. J.; Haas, H.; Decker, R. H.; *et al.* (Max v. Pettenkofer-Institut fur Hygiene und Medizinische Mikrobiologie, Pettenkoferstr. 9a, 8000 Munchen 2, W. Germany). *J. Med. Virol.* 1(3): 163-173; 1977.

Serial blood and fecal samples were collected from a total of 53 patients and family contacts during an outbreak of hepatitis A in a village of 6,361 inhabitants. The samples were tested by a solid-phase competitive type radioimmunoassay for hepatitis A antigen and hepatitis A antibody. The amount and duration of excretion of hepatitis A antigen was correlated with

the severity of the illness. In two severe clinical cases, hepatitis A antigen was demonstrated in fecal extracts 11 days before the onset of jaundice and continuing for 10 days thereafter, with maximum shedding during the late incubation period. Fecal antigen was demonstrated in low concentrations for only 2 days in a patient with mild disease and in a person with subclinical infection. There was an inverse correlation between the incidence of infection and prevalence of hepatitis A antibody and age. Of 24 infections, 19 occurred in persons in the age group 0 to 20 yr, a group in which only 6% of individuals had pre-existing antibody. Hepatitis A antibody was present in the serum of three persons in low titers of 1:20 to 1:40 on the day jaundice developed. The antibody titers increased very rapidly during the following 2 weeks of illness and slowly during the following months, reaching titers of 1:900 to 1:3,500. In a separate study, a mean antibody titer of 1:591 was found in 13 patients, 12 yr after clinical hepatitis A with jaundice.

4132 DETECTION OF HEPATITIS A ANTIGEN BY IMMUNOFLUORESCENCE. (Eng.) Mathiesen, L. R.; Feinstone, S. M.; Purcell, R. H.; Wagner, J. A. (Natl. Inst. Allergy and Infectious Diseases, Bethesda, MD 20014). *Infect. Immun.* 18(2):524-530; 1977.

Hepatitis A antigen (HAAg) was demonstrated by immunofluorescence (IF) in liver biopsies from chimpanzees with experimental hepatitis A virus infection. Blocking experiments with paired sera from patients with hepatitis types A, B, or non-A, non-B, as well as with purified HAAg, showed that the fluorescence was specific for HAAg. HAAg was demonstrated only in biopsies from chimpanzees inoculated with hepatitis A virus. In two of four chimpanzees biopsied weekly (from before experimental inoculation through convalescence), HAAg was detected by IF before stool shedding of HAAg, elevation in SGPT, or histopathological evidence of liver disease was seen. The HAAg was detected for 4-5 weeks; the last IF-positive biopsy was obtained after SGPT activity had returned to normal. In the two other chimpanzees, HAAg was detected only in the biopsy taken at the time of SGPT elevation. In the early IF-positive biopsies, HAAg was diffusely distributed in the cytoplasm of many cells, but it later accumulated in a focal distribution in the cytoplasm of a few of the hepatocytes and Kupffer cells. This cytoplasmic distribution agrees with previous electron microscopic data.

4133 HEPATITIS A-VIRUS PARTICLES IN STOOLS OF PATIENTS FROM A NATURAL HEPATITIS OUTBREAK IN GERMANY. (Eng.) Flehmig, B.; Frank, H.; Frosner, G. G.; Gerth, H. J. (Hygiene-Institut, Universitat Tubingen, 7400 Tubingen, W. Germany). *Med. Microbiol. Immunol.* 163(3):209-214; 1977.

During a hepatitis outbreak in Southern Germany, 27-nm particles were visualized by immune electron microscopy in the stools of two patients. These particles were serologically similar to hepatitis A virus particles identified in the United States. The buoyant density of these particles was 1.34 g/cm^3 as determined by cesium chloride density centrifugation. The particles were first observed in small numbers in a stool obtained 11 days, and in large numbers in stools obtained 6 and 7 days before the onset of jaundice. Few particles were seen on the day of the onset of jaundice and none thereafter. In both patients, a sereoconversion to hepatitis A virus was demonstrated by immune electron microscopy.

4134 OCCURRENCE OF e ANTIGEN IN ACUTE HEPATITIS B. (Eng.) Gibson, P. E.; Ruparelia, K. (Central Public Health Lab., Colindale Ave., London NW9 5HT, England). *J. Clin. Pathol.* 30(10):925-927; 1977.

The occurrence of e antigen in 44 patients with acute hepatitis B was studied to determine if e was related to the outcome of the illness. In 13.6% of cases, e was detected, and in none of these did the carrier state develop. The hepatitis B surface antigen carrier state developed in 4.6% of the patients and in none of these was e antigen detected. Anti-e was detected in only three cases. Only in the very early acute phase of illness e was detected, and the time that serum samples were taken for the detection of e was considered to be very significant. The occurrence of e was not found to affect the duration of HBs antigenemia in those patients who recovered completely. There was no evidence to indicate that the presence of e indicates an increased risk of chronic liver disease.

4135 RUBELLA ANTIBODIES AND ACUTE VIRAL HEPATITIS. (Eng.) Sloth, K.; Vaheri, A.; Laitinen, O.; Faber, V.; *et al.* (Statens Seruminstitut, Amager Blvd. 80, DK-2300 Copenhagen S, Denmark). *Scand J. Infect. Dis.* 9(3):161-165; 1977.

The frequency of the association between high antibody titers against rubella and measles viruses and acute hepatitis was evaluated in 97 hepatitis patients and in 97 age- and sex-matched controls. Hemagglutination inhibition (HI) and complement fixation (CF) antibodies to rubella, measles, and influenza A viruses were determined in all subjects. In patients, particularly in those over 30 yr of age, a small but statistically significant increase in rubella HI titers was seen. In three hepatitis cases, the rubella HI titers were very high (≥2,560). The antibody levels against measles and influenza A viruses did not differ from those in the controls. The data indicate that a small proportion of acute hepatitis patients show a transient strong humoral immune response to rubella virus.

4136 INDIVIDUAL FREE FATTY ACIDS IN PATIENTS WITH LIVER DISEASE. (Eng.) Gunnlaugsson, O.; Berkowitz, D. (St. Joseph's Hosp., Reykjavik, Iceland). *Am. J. Dig. Dis.* 22(11):1005-1009; 1977.

The total free fatty acids, blood glucose, and individual free fatty acids were studied in 8 patients with viral hepatitis and 13 with cirrhosis. The results were compared with those obtained in nine normal controls. Free fatty acids were significantly elevated ($p<0.05$) in the patients with liver disease as compared with normal controls. A fall in free fatty acids following the ingestion of amino acids and dextrose was noted in normal subjects as well as liver patients. The glucose tolerance test was abnormal in five of seven patients with hepatitis and in four of six with cirrhosis but in none of the controls. Highly significant ($p<0.01$) differences were found in the composition of individual free fatty acids in patients with liver disease as compared with normal subjects; arachidonic and linoleic acids were decreased, while monounsaturated and saturated fatty acids were increased in patients with viral hepatitis and cirrhosis. No significant changes were noted in the percentage composition of individual free fatty acids following the ingestion of amino acids and dextrose.

4137 VIRAL HEPATITIS. (Eng.) Naidoo, G.; Van Aswegen, G.; Keeton, G. R. (Somerset Hosp., Green Point, Cape Town 8051, South Africa). *S. Afr. Med. J.* 51(4):99-100; 1977.

4138 AN INVESTIGATION OF AN INTIMATE EPIDEMIC OF VIRAL HEPATITIS [Abstract]. (Eng.) Conn, H. O.; Hoofnagle, J. H. (Veterans Admin. Hosp., West Haven, CT). *Gastroenterology* 72(5, Part 2):1177; 1977.

4139 ACUTE HEPATITIS IN MAN: INCREASED ACTIVITY OF LYSOSOMAL CHOLESTEROL ESTER HYDROLASE [Abstract]. (Eng.) Simon, J. B.; Poon, R. W. M. (Dept. Medicine, Queen's Univ., Kingston, Ontario, Canada). *Clin. Res.* 25(5):689A; 1977.

4140 CLINICAL AND EXPERIMENTAL STUDIES ON ENDOTOXEMIA AND DISSEMINATED INTRAVASCULAR COAGULATION IN FULMINANT HEPATITIS [Abstract]. (Eng.) Yoshimura, R.; Fujiyama, S. (Osaka City Univ. Sch. Medicine, Osaka, Japan). *Gastroenterol. Jpn.* 12(4):326-327; 1977.

4141 EFFECT OF HEPARIN ON FULMINANT HEPATITIS [Abstract]. (Eng.) Maeyama, T.; Tanikawa, K. (Kurume Univ. Medical Sch., Japan). *Gastroenterol. Jpn.* 12(4):327; 1977.

4142 TREATMENT OF FULMINANT HEPATITIS WITH HEMOPERFUSION [Abstract]. (Eng.) Ota, K.; Obata, H. (Tokyo Women's Medical Coll., Tokyo, Japan). *Gastroenterol. Jpn.* 12(4):327; 1977.

See also, 3696, 4087, 4109, 4110, 4115, 4197.

LIVER AND BILIARY TRACT

Chronic Hepatitis

4143 ACTIVE CHRONIC HEPATITIS: PART 2. (Eng.) Fulton, T.; McCann, V. J. (Royal Perth Hosp., Perth, Western Australia, Australia). *Ulster Med. J.* 45(2):195-204; 1976.

To test the effectiveness of corticosteroid therapy in hepatitis B surface antigen (HBsAG)-negative chronic active hepatitis, 40 patients were treated and observed for 4 months to 13 yr. An initial daily dose of 40-45 mg prednisolone (range, 20-90 mg), gradually reduced to a maintenance dose of 2.5-20 mg/day, was given to 15 patients. Twenty-two patients were given corticotropin (40 U/day, i.m.), which was slowly reduced to an average maintenance dose of 30 U twice weekly. Three patients were given betamethasone. A complete remission was experienced by 17 patients in an average time of 19 months. Nine patients maintained slightly elevated ESR, γ-globulin, transaminase, and alkaline phosphatase levels. Six patients showed good clinical response with only marginal improvement of abnormal liver tests. The remaining eight patients were considered "treatment failures." Twenty-five patients experienced complications of treatment. In seven patients, the complications were considered to be serious; three patients on corticotropin experienced transient hyperglycemia, and two patients had worsening of pre-existing diabetes. One patient on prednisolone experienced persistent hyperglycemia, and one experienced transient hyperglycemia. During the follow-up period, ranging from 4 months to 13 years, 26 patients underwent 58 relapses, 44 of which were hepatic in type. Six of the relapses were characteristic of systemic lupus erythematosus episodes. Twelve of the 40 patients have died. Corticotropin and corticosteroid treatment appear to produce a marked symptomatic improvement with a positive clinical and biochemical picture when the

treatment is life-long. The side-effects, more numerous with corticosteroids, are out-weighed by the possibility of developing cirrhosis.

4144 EVIDENCE FOR PHASIC SEQUENCES IN NUCLEAR HBcAg FORMATION AND CELL MEMBRANE-DIRECTED FLOW OF CORE PARTICLES IN CHRONIC HEPATITIS B. (Eng.) Gudat, F.; Bianchi, L. (Dept. Pathology, Univ. Basel, CH-4056 Basel, Switzerland). *Gastroenterology* 73(5):1194-1197; 1977.

Liver biopsy specimens from six patients with chronic aggressive hepatitis B and from one kidney transplant recipient with chronic persistent hepatitis B were examined to study distribution patterns of hepatitis B core antigen (HBcAg). Differential distribution patterns of HBcAg (with gradual transitions) were seen: pure nuclear, mixed nuclear/cytoplasmic, and pure cytoplasmic (diffuse and/or submembraneous). This distribution was combined with spotty expression of hepatitis B surface antigen (HBsAg) in the cytoplasm and liver cell membrane and with Dane particles (DP) in blood. A phasic nuclear formation and release of cores from the nucleus and of DP from the cell, resp., is suggested. Electron microscopy of one biopsy indicates a secretory disturbance as a possible cause for HBcAg accumulation in liver cells, the tolerance of which is attributed to immunosuppression therapeutically induced in four patients and suspected in three (2 dialysis patients, 1 with spontaneous chronic aggressive hepatitis B).

4145 CHRONIC HEPATITIS IN HEMOPHILIA. (Eng.) Hasiba, U.; Spero, J. A.; Lewis, J. H. (Central Blood Bank Pittsburgh, 812 Fifth Ave., Pittsburgh, PA 15219). *Scand. J. Haematol.* (Suppl. 30):27-32; 1977.

The relationship of chronic hepatitis B and/or liver dysfunction to treatment in 113 hemophiliacs was evaluated by determining SGOT and SGPT, and by the presence of circulating hepatitis B surface antigen (HBsAg) or antibody (anti-Hbs). The hemophiliacs were divided into three groups according to treatment pattern. Individuals who had received multiple doses of plasma fractions, derived from four or more commercial lots were placed in group I; group II had been treated with fractions from three or fewer lots; and group III had never received commercial fractions, but had been treated with cryoprecipitate. Abnormal liver function tests (LFTs) were found in 87% of group I and 76% of group II, but in only 16% of group III. Differences in LFTs were minor between treated factor VIII- and IX-deficient patients. All patients treated with 100,000 U or more showed either persistent or intermittent abnormalities. In group I, the history of past, overt hepatitis had no influence on observed LFTs. The sera of all patients in the high exposure and all but one in the low exposure groups were positive for HBsAg or anti-Hbs by radioimmunoassay. Splenomegaly was found in 13% of fraction-treated patients. It is concluded that there is biochemical evidence of liver disease following large exposure to commercial factor VIII or IX fractions, which should temper the physician's decision to start treatment with these fractions. On the other hand, evidence that their continued use produces mounting liver dysfunction is insufficient to withdraw this very effective and life-changing treatment from these individuals.

4146 RAPID PROGRESSION OF CHRONIC ACTIVE TYPE B HEPATITIS IN A PATIENT WITH HYPOGAMMAGLOBULINEMIA. (Eng.) Tong, M. J.; Nies, K. M.; Redeker, M. D. (Los Amigos Hosp., Building 1100, Room 53, 7601 E. Imperial Highway, Downey, CA 90242). *Gastroenterology* 73(6):1418-1421; 1977.

The case of a 19-yr-old man with hypogammaglobulinemia in whom acute hepatitis B rapidly progressed to chronic active liver disease and cirrhosis is described. Absent circulating IgA, significantly low IgG, and normal IgM levels were detected during the acute phase of illness. Enumeration of peripheral lymphocytes revealed a decreased number of T cells and normal numbers of B cells. *In vitro* pokeweed stimulation of immunoglobulin synthesis correlated with the *in vivo* circulating levels of the three immunoglobulins. Cell-mediated immune responses were normal except for lymphocyte stimulation to hepatitis B surface antigen. It is concluded that the defective synthesis of IgG and IgA antibodies to hepatitis B surface antigen contributed to the accelerated progression to chronic active type B hepatitis in this patient.

4147 ON THE PATHOGENESIS OF EARLY RENAL IMPAIRMENT IN CHRONIC ACTIVE LIVER DISEASES (CALD) [Abstract]. (Eng.) Gentilini, P.; Laffi, G.; Buzzelli, G.; Stefani, P.; Masi, R. (III. Dept. Medical Pathology, Univ. Florence, Florence, Italy). *Digestion* 16(4):348-349; 1977.

See also, 4087, 4104, 4109, 4110, 4115, 4149.

LIVER AND BILIARY TRACT

Alcoholic Liver Disease

4148 GIANT MITOCHONDRIA IN HEPATOCYTES: A DIAGNOSTIC HINT FOR ALCOHOLIC LIVER DISEASE. (Eng.) Bruguera, M.; Bertran, A.; Bombi, J. A.; Rodes, J. (Hospital Clínico y Provincial, Barcelona, Spain). *Gastroenterology* 73(6):1383-1387; 1977.

One hundred and sixty-five coded liver biopsy speci-

mens from chronic alcoholics and specimens from nondrinkers or subjects with low alcoholic intake were studied by light microscopy to evaluate the occurrence and diagnostic significance of giant mitochondria, which have been identified as PAS-negative globular hyalin cytoplasmic inclusions of regular outline, clearly distinguishable from Mallory bodies. In four cases, electron microscopy confirmed that these globules were in fact enlarged mitochondria. The incidence of giant mitochondria was significantly higher in patients with high alcohol consumption (72%) than in those with low or no alcohol intake (10%). Their presence was related to the amount of daily ethanol consumption and to the shortness of abstinence before the biopsy. It was independent of other changes in the liver, and was detected with similar frequency in biopsies showing different alcoholic liver diseases. This study emphasizes that giant mitochondria may be detected by light microscopy in a high proportion of alcoholics, and rarely in nonalcoholic liver diseases. Although less specific, they are much more frequent than Mallory bodies. Consequently, they should be considered as a diagnostic hint of recent and heavy alcoholism.

4149 ASYMPTOMATIC LIVER DISEASE IN ALCOHOLICS. (Eng.) Bruguera, M.; Bordas, J. M.; Rodes, J. (Hospital Clinico y Provincial, Barcelona, Spain). *Arch. Pathol. Lab. Med.* 101(12):644-647; 1977.

The incidence and nature of liver damage were examined in 154 consecutive asymptomatic chronic alcoholics, and the value of clinical and biochemical examination for predicting the presence of liver disease was assessed. Several types of histologic changes of the liver (cirrhosis, hepatitis, fatty change, hemosiderosis, portal fibrosis) were found in 116 of the alcoholics. No relation was found between the nature of the hepatic damage and either the duration of alcoholism or the presence or degree of clinical and biochemical disturbances. The results of clinical and biochemical examination (presence or absence of hepatomegaly, presence of one or more biochemical abnormalities) of 55 patients with histologic abnormalities were normal, and these patients were considered as apparently healthy alcoholics. Liver biopsy specimens from 61 of 69 asymptomatic alcoholics, who had abnormalities on clinical and/or biochemical investigation, showed hepatic damage under light microscopy, but specimens from the other eight were histologically normal. Conventional liver function tests have limited value in detecting the existence and severity of liver injury, while liver biopsy specimens may reveal a large range of abnormalities in asymptomatic alcoholics.

4150 MEASUREMENT OF ALCOHOL-RELATED EFFECTS IN MAN: CHRONIC EFFECTS IN RELATION TO LEVELS OF ALCOHOL CONSUMPTION. PART A. (Eng.) Turner, T. B.; Mezey, E.; Kimball, A. W. (Johns Hopkins Medical Inst., Baltimore, MD). *Johns Hopkins Med. J.* 141(5):235-248; 1977.

Information concerning intake-effect relations between alcohol intake and chronic dysfunctions of the liver, pancreas, cardiovascular system, testis, and fetus are reviewed. Alcohol and the elderly, evidence of favorable effects of alcohol, and the question of alcoholism are also discussed. In the majority of studies, the documented daily intake levels have been over 150 g of ethanol (the equivalent of 1 pint of 80-proof spirits), often in the range of 250-300 g. Other potential risk factors such as malnutrition are rarely considered, and little information is available on the effects of more moderate daily intake. The liver emerges as the organ most vulnerable to regular alcohol use, with the hazardous range beginning at a daily intake of 80-100 g of ethanol. There is some evidence of beneficial effects, especially in the elderly, of daily intakes of 15-30 g, and epidemiological evidence exists of a lower incidence of myocardial infarction in those with a daily intake approximating 56 g. More information is needed on chronic intake-effect relationships, particularly at levels below 150 g.

4151 CHEMICAL NATURE OF ALCOHOLIC HYALIN. (Eng.) Luisada-Opper, A. V.; Kanagasundaram, N.; Leevy, C. M. (Coll. Medicine and Dentistry of New Jersey, Newark, NJ 17103). *Gastroenterology* 73(6):1374-1376; 1977.

The nature of protein components present in a purified alcoholic hyalin preparation was investigated. Alcoholic hyalin was prepared from postmortem livers of patients with alcoholic liver disease and purified by discontinuous sucrose density gradient ultracentrifugation. The purified protein preparation contained about 12% reducing sugar, the remainder being protein. Gel filtration on a Sephadex 4B column showed the presence of three peaks. The material in each peak contained acetylglucosamine, hexosamine, and deoxysugar (calculated as rhamnose). That these protein components are glycoprotein in nature was confirmed by polyacrylamide gel electrophoresis followed by scanning the gels at 280 nm and then at 520 nm (after staining the gels with PAS base reagent for the presence of carbohydrate).

4152 ALCOHOLIC HYALIN ANTIGEN (AHAg) AND ANTIBODY (AHAb) IN ALCOHOLIC HEPATITIS. (Eng.) Kanagasundaram, N.; Kakumu, S.; Chen, T.; Leevy, C. M. (Coll. Medicine and Dentistry of New Jersey, 100 Bergen St., Newark, NJ 17103). *Gastroenterology* 73(6):1368-1373; 1977.

Serum and tissue from subjects without liver disease and from patients with various hepatic diseases were studied by complement fixation (CF) and immune adherence (IA) hemagglutination tests to characterize alcoholic hyalin (AH) isolated from human postmortem liver, to determine the diagnostic value of AH antigen (AHAg), and to investigate the occurrence and significance of tissue immune complexes in alcoholic hepatitis. Isolated purified AH was used to produce AH antibody (AHAb) in rabbits. Rabbit antiserum was added to heat-inactivated human serum

to detect AHAg; purified AH was added to serum and tissue eluates to detect AHAb. AHAg was present in the serum of each of 15 patients with early phase alcoholic hepatitis in CF titers of 8 to 64 and IA titers of 16 to 2,048. AHAg became negative within 3 to 5 weeks with abstinence from alcohol and was followed by transient appearance of AHAb. AHAb was present in 11 patients with advanced phases of alcoholic hepatitis in CF titers of 8 to 640 and IA titers of 16 to 4,096. Four patients in this group exhibited concomitant AHAb and AHAg. Investigations of liver tissue eluate reveal that patients with advanced alcoholic hepatitis or active alcoholic cirrhosis have AHAg-reactive immune complexes containing IgG and IgA.

4153 CLINICOPATHOLOGICAL STUDY OF ALCOHOLIC LIVER INJURY IN JAPAN [Abstract]. (Eng.) Inoue, K.; Sato, E. (Toyama Medical and Pharmaceutical Sch., Tohama, Japan). *Gastroenterol. Jpn.* 12(4):340; 1977.

4154 A PATHOGENESIS OF ALCOHOLIC LIVER INJURY [Abstract]. (Eng.) Okabe, K. (St. Marianna Univ. Sch. Medicine, Kanagawa, Japan). *Gastroenterol. Jpn.* 12(4):339-340; 1977.

See also, 3844, 3880, 3887, 3895, 4087, 4104, 4113, 4115, 4174, 4175.

LIVER AND BILIARY TRACT

Cirrhosis

4155 HEPATIC KINETICS OF ^{99m}TECHNETIUM SULFUR COLLOID IN CIRRHOSIS. (Eng.) George, E. A.; Shields, J. B.; Cabal, E. C.; Schulz, R. C.; Donati, R. M. (St. Louis Veterans Admin. Hosp., St. Louis, MO 63125). *J. Nucl. Med. All. Sci.* 21 (3):107-112; 1977.

Experience with an index of hepatic arterial and portal venous circulation determined by analysis of the kinetic sequence of events that followed the peripheral venous injection of ^{99m}technetium (^{99m}Tc) sulfur colloid in 97 subjects is presented. Evaluation of portal hemodynamics during the first hepatic transit of ^{99m}Tc sulfur colloid by sequential hepatic imaging (visual evaluation) and by computer-assisted calculation of percent portal extraction of the radiocolloid suggested good correlation with the clinical entity. Percent portal hepatic extraction of sulfur colloid correlated well with corrected hepatic wedge pressure obtained in 20 control patients and in 42 patients with uncomplicated cirrhosis. Slight to moderately elevated corrected hepatic wedge pressure appeared to inversely parallel the degree of diminished percentage of portally extractable radiocolloid. Portasystemic shunting, which tends to normalize corrected hepatic wedge pressure, may decrease further portal extraction until undetectability, which, however, compares better with the abnormal hepatic hemodynamics at hand than a normal hepatic wedge pressure gradient. Similarly, prehepatic portal hypertension secondary to portal or mesenteric thrombosis was not reflected by an elevated corrected hepatic wedge pressure but was well demonstrated by the radionuclide technique. The data suggest that the technique of the calculation of percentage of portally extractable sulfur colloid could serve as a sensitive indicator for the detection, progression, or recovery from hepatic hemodynamic abnormalities. The technique, however, does not offer an index of portal pressure gradients in advanced cirrhosis and postsurgical portasystemic shunting.

4156 IS PRIMARY BILIARY CIRRHOSIS AN IMMUNE COMPLEX DISEASE? (Eng.) Thomas, H. C.; Potter, B. J.; Sherlock, S. (Royal Free Hosp., London, England). *Lancet* 2(8051):1261-1263; 1977.

The possibility that primary biliary cirrhosis is related to immune complex liver injury is discussed. Large immune complexes are present in the circulation of patients with primary biliary cirrhosis and result in the activation of complement by the classical pathway. Such large complexes are capable of producing tissue damage. The granulomatous lesions surrounding the small bile ducts within the liver of patients with primary biliary cirrhosis and the vasculitis, rheumatoid arthritis, and associated lesions are all compatible with immune complex injury. It is postulated that such large complexes could be formed in the vicinity of the bile ducts by an antigen absorbed from the bile or biliary epithelium. Complexes reaching the systemic circulation might be responsible for the associated extrahepatic diseases.

4157 ASSOCIATION OF HUMAN LEUKOCYTE ANTIGEN (HLA)-B5 AND -BW22-J WITH HEPATIC CIRRHOSIS OF APPARENTLY UNKNOWN ETIOLOGY. (Eng.) Ohkubo, A.; Okimoto, K.; Iwasaki, Y.; Kosaka, K.; Juji, T.; Tohyama, H. (Faculty Medicine, Univ.

Tokyo, Tokyo 113, Japan). *Tohoku J. Exp. Med.* 123 (3):257-263; 1977.

The association of histocompatibility antigens HLA-BW22-J (a Japanese-specific HLA antigen) and HLA-B5 with hepatic cirrhosis of unknown etiology was studied in 29 patients with histologically proven hepatic cirrhosis (based on needle biopsy) and in 128 healthy controls, all randomly selected. HLA types were determined for the first (A) and the second (B) loci by the lymphocytotoxicity technique. Of the 29 patients, 5 were positive for hepatitis B surface antigen (HBsAg), and 4 had cirrhotic patients in their families, 2 of which cases were HBsAg-positive. Twenty-one of the 29 patients were positive for HLA phenotype B5 and 11 for phenotype BW22-J. Forty-one of the 128 controls were positive for B5 and 13 for BW22-J. The differences in frequencies of B5 and BW22-J between the patients and the controls were statistically significant ($p<0.003$ and relative risk=5.57 for B5, and $p<0.01$ and relative risk=5.40 for BW22-J). The results suggest that a predisposition linked to HLA-associated genes plays an important role in development of hepatic cirrhosis of unknown etiology in Japan; further studies are required that will bear upon prevention and treatment of this entity.

4158 RELATIVE CONCENTRATIONS OF INDIVIDUAL NONSULFATED BILE ACIDS IN THE SERUM AND BILE OF PATIENTS WITH CIRRHOSIS. (Eng.) Struthers, J. E., Jr.; Mehta, S. J.; Kaye, M. D.; Naylor, J. L. (Veterans Admin. Hosp., 1055 Clermont St., Denver, CO 80220). *Am. J. Dig. Dis.* 22(10):861-865; 1977.

The relative concentrations of individual nonsulfated bile acids were determined in samples of serum and bile obtained simultaneously from 16 patients with biopsy proven alcoholic cirrhosis. A highly significant ($p<0.001$) correlation was found between the fasting relative concentrations of each of the three major bile acids (cholic, chenodeoxycholic, and deoxycholic) in serum and bile. This relationship persisted after manipulation of bile acid pools produced by feeding individual bile acids (250, 100, and 100 mg, 4x/day for cholic, deoxycholic, and taurodeoxycholic acids, resp.) for 4 days. It is concluded that the relative concentrations of individual nonsulfated bile acids in serum accurately reflect those in bile and that measurement of individual serum bile acids may be used for screening and serial determination purposes. In particular, low levels of biliary deoxycholate can be reliably predicted by serum measurements.

4159 FIBRIN-FIBRINOGEN DEGRADATION PRODUCTS IN HEPATIC CIRRHOSIS. (Eng.) Bulajic, M.; Kovacevic, N.; Lalic, M.; Rolovic, Z. (Medical Faculty, Univ. Beograd, Beograd, Yugoslavia). *Acta Med. Iugosl.* 31(4):333-338; 1977.

To investigate the possible role of disseminated intravascular coagulation in the pathogenesis of hemorrhage in hepatic cirrhosis, the severity of liver damage was correlated with the concentration of serum fibrin-fibrinogen degradation products in 14 patients with compensated or noncompensated liver cirrhosis. Increased fibrin-fibrinogen degradation products were found only in three of the six patients with alcoholic cirrhosis. Although there were differences in the level of fibrin-fibrinogen degradation products in patients with decompensated and compensated cirrhosis, this difference was not statistically significant. It is concluded that the frequency of the elevated fibrin-fibrinogen degradation products in cirrhosis is low. Other factors must be sought to account for hemorrhage in cirrhosis.

4160 ASSOCIATION OF ABNORMAL FIBRIN POLYMERISATION WITH SEVERE LIVER DISEASE. (Eng.) Green, G.; Poller, L.; Thomson, J. M.; Dymock, I. W. (Rancho Los Amigos Hosp., Downey, CA 90242). *Gut* 18(11):909-912; 1977.

To investigate the frequent occurrence of abnormal fibrin polymerization reported in patients with liver disease, fibrin polymerization was studied in 68 patients with cirrhosis or chronic active liver disease. Thirty-three of these patients demonstrated impairment of this phase of blood coagulation. When other tests of liver function were compared in patients with this abnormality and in those in whom fibrin polymerization was normal, the former group demonstrated significantly reduced albumin concentrations ($p<0.0002$), raised bilirubin and aspartate amino transferase levels ($p<0.0006$ and <0.003, resp.), and greater prolongation of the one-stage prothrombin time ($p<0.001$) with more marked reduction in factor VII levels ($p<0.002$) compared with the latter patients. It is concluded that defective fibrin polymerization occurring in patients with liver disease indicates the presence of severely impaired hepatocellular function. This fact might account for the grave prognosis reported in cirrhotic patients with abnormal fibrin polymerization who also suffer bleeding from gastroesophageal varices.

4161 HEPARIN ELIMINATION IN PATIENTS WITH LIVER CIRRHOSIS. (Eng.) Teien, A. N. (Aker Hosp., Oslo 5, Norway). *Thromb. Haemostas.* 38(3): 701-706; 1977.

Heparin metabolism was studied in six patients with liver cirrhosis and normal renal function and in six normal subjects. Heparin (100 U/kg) was injected i.v., and heparin concentration in plasma was determined by polybrene titration. The mean heparin half-life was 117.8 min in the patients as compared to 74.0 min in the controls ($p=0.02$). The heparin half-life was correlated to galactose half-life in the patients ($r=0.83$, $p=0.05$). The findings suggest that heparin is metabolized in the liver. There was a significant decrease in antithrombin III activities in the controls, but not in the patients. A possible explanation may be that the normal liver removes heparin bound to antithrombin III, and that this function is impaired in liver cirrhosis.

4162 ABSORPTION, HYDROXYLATION, AND EXCRETION OF VITAMIN D_3 IN PRIMARY BILIARY CIRRHOSIS. (Eng.) Krawitt, E. L.; Grundman, M. J.; Mawer, E. B. (Dept. Medicine, Univ. Vermont, Burlington, VT). *Lancet* 2(8051):1243-1249; 1977.

The absorption of a p.o. dose of ^{3}H-vitamin D_3 and the 25-hydroxylation of i.v. administered ^{14}C-vitamine D_3 were studied simultaneously in six patients with primary biliary cirrhosis and in four controls. Vitamin D_3 (3 µg, 8 µCi, p.o.) was poorly absorbed by four of the six patients with primary biliary cirrhosis; absorption was negatively correlated with fecal fat excretion. 25-Hydroxylation of p.o. or i.v. vitamin D_3 was not impaired in the patients compared with controls of similar vitamin D nutritional status. Urinary radioactivity derived from the i.v. dose of vitamin D_3 (25 µg, 2 µCi) was significantly greater in patients than in controls (mean excretion 9.1 ± 2.6% of injected dose in patients, 2.8 ± 0.4% in controls) and was positively correlated with the serum bilirubin concentration ($r=0.92$, $p=0.005$). Urinary excretion may lead to loss of administered and endogenous vitamin D and thus contribute to vitamin D deficiency in patients with primary biliary cirrhosis.

4163 DETECTION OF HEPATOMA IN LIVER CIRRHOSIS. (Eng.) Moreau, R.; Soussaline, F.; Chauvaud, S.; Parmentier, C.; Di Paola, R.; Charbord, P.; *et al.* (Laboratoire des Isotopes, Inst. Gustave-Roussy, F-94800 Villejuif, France). *Eur. J. Nucl. Med.* 2(3):183-188; 1977.

Double isotope scintigraphies with ^{67}Ga citrate and ^{99m}Tc sulfur colloid were used with digital subtraction, after simultaneous recording of ^{99m}Tc and ^{67}Ga data on magnetic tape (by an interface) in 33 cirrhotic patients for the detection of hepatoma. Hepatoma was diagnosed histologically in six cases. Using this double isotope technique, there were no false-positives in subtraction scintigrams. There was one false-negative because of the lack of significance in the subtracted image for one of the six patients with liver cancer. For three of the six patients with hepatoma, the ^{67}Ga scintigram showed an increased uptake in the tumor area. For the three other cases, the ^{67}Ga uptake was equilibrated throughout the liver scintigraphy. The subtraction technique is of greatest value in cases where the ^{67}Ga scintigram shows no increased activity, as it permitted the diagnosis of hepatoma in two cases.

4164 SERUM Gc SYSTEM IN LIVER CIRRHOSIS AND HEPATOMA. (Eng.) Theodoropoulos, G.; Rigatos, G.; Babionitakis, A.; Archimandritis, A.; Fertakis, A.; Melissinos, K. (2, Dryadon St., Chalandri-Athens, Greece). *Hum. Genet.* 39(2):225-228; 1977.

Serum group specific component (Gc) polymorphism was studied in 85 Greek patients with liver cirrhosis, in 65 with cirrhosis plus hepatoma, and in 40 with hepatoma without cirrhosis. Six hundred unrelated healthy Greeks served as controls. The Gc 1-1 phenotype was found more frequently ($p<0.0005$-0.05) in patients with cirrhosis (with or without hepatoma), and the incidence of the Gc^1 allele was significantly higher ($p<0.001$-0.05) in patients with cryptogenic hepatitis B surface antigen (HBsAg)-negative cirrhosis. On the other hand, the Gc 2-2 phenotype was found about three times more frequently in patients who had hepatoma without cirrhosis, and the incidence of the Gc^2 allele was significantly higher in the same group than in the controls. The Gc^1 and the Gc^2 alleles apparently predispose, under the influence of various factors, the development of cryptogenic cirrhosis and hepatoma without cirrhosis, resp.

4165 ENCEPHALOPATHY IN PATIENTS WITH CIRRHOSIS OF THE LIVER. A NEUROPSYCHOLOGICAL STUDY. (Eng.) Elsass, P.; Lund, Y.; Ranek, L. (Rigshospitalet, Copenhagen, Denmark). *Scand. J. Gastroenterol.* 13(2):241-247; 1978.

Neuropsychological tests and clinical ratings of consciousness level were performed in 30 patients with encephalopathy due to biopsy-proven liver cirrhosis of various etiology. The results were compared to test norms for patients with diffuse cerebral lesions to give a neuropsychological description of the encephalopathic state of patients with these two entities and to investigate whether the neuropsychological characterization of the encephalopathic course differs between patients with a portacaval anastomosis and patients without this operation. The level of consciousness was evaluated on the basis of such criteria as blurred speech; slow, inert reactions; sleepiness; psychomotor uneasiness; apathy; lack of spontaneity; absentmindedness; emotional instability; euphoria; and bizzare behavior. Neuropsychological tests included subtraction, block design/hidden patterns, visual gestals, digit span, word fluency, and story recall/picture recognition. All patients were tested once with both tests to investigate the state of encephalopathy. To investigate the course of encephalopathy, eight patients with portacaval anastomosis were also tested after the surgery, and eleven unoperated patients were tested once a week during 3 weeks. The neuropsychological tests were graded according to the norms for diffuse cerebral lesion and showed that three-fifths of the patients had intellectual impairments while the remaining two-fifths had an intact level of functioning. However, according to clinical ratings, one-third showed a suspect lowered level of consciousness without general intellectual impairment, while one-tenth had slight intellectual impairment but a normal level of consciousness. In all cases of lowered level of consciousness, the function of attention was impaired; the functions of memory and abstraction were less impaired than attention. In the eight patients with portacaval anastomosis, the level of consciousness varied, generally deteriorated in parallel with liver function, and could vary hourly; this group showed significant ($p<0.01$-0.02) reductions in the scores of memory and abstraction tests, which is characteristic of intellectual impairment in diffuse cere-

bral lesions. The patient group without portacaval anastomosis showed variations in level of consciousness similar to those of the operated group but no significant deteriorations in any of the test results within the investigations performed. The level of attention is an important part of the clinical picture in encephalopathy due to liver cirrhosis and differentiates well between patients with diffuse cerebral lesions and those with hepatic encephalopathy. The cerebral effect of portacaval anastomosis appears as an intellectual deterioration and produces a different course of cerebral affection than that seen in patients without this operation.

4166 EFFECT OF VEGETABLE AND ANIMAL PROTEIN DIETS IN CHRONIC HEPATIC ENCEPHALOPATHY. (Eng.) Greenberger, N. J.; Carley, J.; Schenker, S.; Bettinger, I.; Stamnes, C.; Beyer, P. (Kansas Univ. Medical Center, 39 and Rainbow, Kansis City, KS 66103). *Am. J. Dig. Dis.* 22(10):845-855; 1977.

The effect of a vegetable protein diet as compared to an animal protein diet on standard clinical and laboratory parameters was examined in three patients with chronic hepatic encephalopathy. To evaluate more objectively the effects of vegetable or animal protein diets, an hepatic encephalopathy index was developed, and this included the following parameters: fetor hepaticus, asterixis, stage of hepatic coma (Parson-Smith), arterial ammonia levels, EEG, Reitan trail test, and any reduction or improvement in dietary protein tolerance. In controlled, randomized, single-blind trials, it was found that a vegetable protein diet resulted in overall clinical improvement, decreased hepatic encephalopathy index scores, decreased arterial ammonia levels, improved performance on intellectual tasks, and in one case, markedly improved protein tolerance. Further, the beneficial effects of a vegetable protein diet were enhanced by the use of lactulose. These studies do not provide a clear-cut definition of the mechanism for the observed beneficial effects of vegetable protein in chronic hepatic encephalopathy. However, the most plausible explanation is that vegetable protein diets contain lower amounts of certain amino acids and other materials that may be important in the pathogenesis of hepatic encephalopathy.

4167 INCREASED CONCURRENCE OF CIRRHOSIS AND BACTERIAL ENDOCARDITIS: A CLINICAL AND POSTMORTEM STUDY. (Eng.) Snyder, N.; Atterbury, C. E.; Correia, J. P.; Conn, H. O. (Veterans Admin. Hosp., West Haven, CT 06516). *Gastroenterology* 73(5):1107-1113; 1977.

To test the hypothesis that spontaneous bacterial peritonitis in cirrhosis is caused by the infection of pre-existing ascites by blood borne bacteria (making other sites vulnerable to infection), the frequency of bacterial endocarditis in cirrhotic and noncirrhotic patients was determined. At autopsy, bacterial endocarditis was found in 1.8% of 557 cirrhotic patients compared to 0.9% of 3,658 noncirrhotic patients ($p<0.06$), despite the expected negative association predicted by Berkson's hypothesis. There was no such association between bacterial endocarditis and either myocardial infarction or emphysema. There were highly significant negative associations between glioblastoma multiforme and cirrhosis ($p<0.01$), myocardial infarction ($p<0.01$), and emphysema ($p<0.02$). Among the 41,151 patients admitted to the hospital, bacterial endocarditis was observed in 0.1% of the noncirrhotic patients compared to 0.34% of the cirrhotic patients ($p<0.001$). The bacterial endocarditis in cirrhosis differed from the conventional syndrome in several ways. Nonrheumatic heart disease, especially calcific aortic stenosis, occurred more frequently in noncirrhotic than in cirrhotic patients. Enteric bacteria are responsible for a higher percentage and α-hemolytic streptococci for a lower percentage of cirrhotic bacterial endocarditis than in conventional bacterial endocarditis. The association between cirrhosis and bacterial endocarditis supports the postulated hematogenous route of infection in spontaneous bacterial peritonitis.

4168 HEPATOMEGALY AND RECURRENT ASCITES IN AN 11-YEAR-OLD BOY. (Eng.) Tang, T. T.; Davis, S.; Keelan, M. H.; Lepley, D., Jr.; Babbitt, D. P. (Milwaukee Children's Hosp., P.O. Box 1997, Milwaukee, WI 53201). *J. Pediatr.* 91(6):1015-1020; 1977.

A case of hepatomegaly and recurrent ascites in an 11-yr-old boy is described. The boy was admitted to a hospital because of increasing abdominal girth. A liver scan suggested a "lymphatic disease" in the left lobe. At exploratory laparotomy the portal pressure was 260 mm H_2O; liver biopsy showed cirrhosis of unknown etiology. Upon a second admission 1 month later, the boy had a proturberant abdomen and the liver edge extended 5 cm below costal margin. At laparotomy, 1,300 ml of clear ascitic fluid was aspirated; normal venous flow and portal pressure were observed in the liver. A liver biopsy was diagnosed as hepatoportal sclerosis with focal cirrhosis; a liver scan was suggestive of cirrhosis. After discharge, the boy's condition remained stable, but 4 months later he was readmitted for paracentesis, and 4,300 ml of amber clear fluid was aspirated. He was treated with hydrochlorothiazide and multivitamins with iron but the ascites recurred. Chest roentgenograms showed minimally enlarged heart and prominent superior vena cava. On the basis of the information available the diagnoses considered were idiopathic cirrhosis, alpha$_1$-antitrypsin deficiency, constrictive pericarditis, and cardiac myxoma. The possibility of constrictive pericarditis was confirmed by careful examination, including inspection of neck veins and determination of atrial, ventral, and hepatic wedge pressures. A thoracotomy was performed, and the pericardium was removed except for a minute shelf on the back of the left atrium. About 4 months later, intracardiac pressures had returned to normal, and the ascites had completely subsided. One year later, the pressure contour in the right

ventricle had become nearly normal, and the early diastolic dip had disappeared. Retrospectively, veno-occlusive disease was suspected on the basis of liver biopsies, but histological and microbiological examination of pericardium gave no clues of possible etiology of constrictive pericarditis. This classic case of idiopathic constrictive pericarditis is an extremely important case for clinical practice, illustrating the critical nature of careful physical examination that would have lead to the correct diagnosis sooner.

4169 HYPOXEMIA OF CIRRHOSIS: DETECTION OF ABNORMAL SMALL PULMONARY VASCULAR CHANNELS BY A QUANTITATIVE RADIONUCLIDE METHOD. (Eng.) Wolfe, J. D.; Tashkin, D. P.; Holly, F. E.; Brachman, M. B.; Genovesi, M. G. (Univ. California Sch. Medicine, Los Angeles, CA 90024). *Am. J. Med.* 63 (5):746-754; 1977.

The pathophysiology of hypoxemia (arterial oxygen tension [PaO_2] 48.5-68 mm Hg) in three patients with hepatic cirrhosis was investigated using conventional cardiopulmonary tests and a special radionuclide technique for the detection of shunting through small dilated pulmonary vessels. Pulmonary function tests revealed normal spirometry and lung volumes, normal closing volume and single-breath nitrogen washout, abnormal diffusing capacity (41-68% of predicted), increased venous admixture of 100% oxygen (8.1-29%), and a decrease in PaO_2 after change from the supine to the sitting position and after exercise. Cardiac catheterization revealed normal pulmonary arterial pressures at rest and during exercise, increased cardiac outputs, and no intracardiac shunts. Chest roentgenograms and pulmonary angiograms were within normal limits. Using a quantitative radionuclide technique, 10%, 46%, and 70.5% of i.v.-injected technetium 99m-macroaggregated albumin (^{99m}Tc-MAA) particles traversed the pulmonary vasculature and lodged in end-organ systemic capillary beds in the three patients with cirrhosis compared with 6% or less in eight controls. The results document the presence of dilated pulmonary capillaries and/or arteriovenous communications that are too small to be detected angiographically. These abnormal vascular channels can account for the hypoxemia observed in patients with liver cirrhosis, primarily on the basis of diffusion/perfusion imbalance and to a lesser extent by true shunting.

4170 DISPOSITION OF NAFCILLIN IN PATIENTS WITH CIRRHOSIS AND EXTRAHEPATIC BILIARY OBSTRUCTION. (Eng.) Marshall, J. P., II; Salt, W. B.; Elam, R. O.; Wilkinson, G. R.; Schenker, S. (Vanderbilt Univ. Sch. Medicine, Nashville, TN 37203). *Gastroenterology* 73(6):1388-1392; 1977.

The effect of cirrhosis and extrahepatic biliary obstruction on the pharmacokinetics of nafcillin was studied in 12 controls, 12 patients with cirrhosis, and 5 patients with extrahepatic biliary obstruction. The plasma clearance of nafcillin in controls was 583 ± 144.2 ml/min and fell strikingly to 291 ± 147.6 and 163 ± 56.3 ml/min in patients with cirrhosis and extrahepatic obstruction, resp. ($p<0.001$). In the latter two groups, nafcillin excreted in urine increased from about 30% to 50% of the administered dose ($p<0.02$), suggesting that renal disease superimposed on hepatic disease would further decrease overall nafcillin clearance. The depression of nafcillin clearance with hepatobiliary disease did not correlate with any conventional liver laboratory test. The initial volume of distribution of nafcillin was unaltered, but at steady state there was a significant reduction in the distribution volume in the patients with liver disease. Accordingly, the impairment in drug elimination, as assessed by its plasma clearance, was underestimated by the prolongation of the nafcillin elimination half-life, which was 1.02 ± 0.20 hr in controls and 1.23 ± 0.31 ($p>0.05$) and 1.73 ± 0.44 hr ($p<0.03$), resp., in patients with cirrhosis and extrahepatic obstruction.

4171 KALLIKREIN-KININ AND RENIN-ANGIOTENSIN SYSTEMS IN FUNCTIONAL RENAL FAILURE OF CIRRHOSIS OF THE LIVER. (Eng.) Wong, P. Y.; Talamo, R. C.; Williams, G. H. (Albany Medical Coll., Albany, NY 12208). *Gastroenterology* 73(5):1114-1118; 1977.

The possibility that abnormal kallikrein-kinin and renin-angiotensin systems may be responsible for functional renal failure was investigated in 15 patients with liver cirrhosis. Seven of these patients (control group) had persistent ascites, prothrombin time more than 3 sec above controls, and normal blood urea nitrogen and serum creatinine. The remaining eight patients had hepatorenal (HR) syndrome (functional renal failure) in alcoholic liver disease. All patients had been on a low sodium (<10 mEq/24 hr) diet for 5 to 6 days. Fasting supine, overnight blood samples were then drawn between 8 and 10 AM. The mean plasma prekallikrein as determined by the tosyl arginine methyl ester (TAMe) esterase method for control patients was 11.6 ± 2.8, whereas that of the HR group was 2.5 ± 1 μM/hr, $p<0.007$ (normal: 95 ± 3.75). The mean plasma bradykinin for the controls was 1 ± 0.44 and that of the HR group was 0.23 ± 0.01 ng/ml, $p<0.001$ (normal: 3.5 ± 1). The mean plasma renin activity for the control group was 26.4 ± 12 and that of four patients in the HR group was 50.4 ± 23 ng/ml/hr (normal: 5.28 ± 1), the difference was not significant despite the elevation in HR patients. The mean angiotensin II for the control group was 94.4 ± 33 and that of the HR group was 356.5 ± 122 pg/ml, $p<0.03$ (normal: 57 ± 7). The combined effects of excess in vasoconstrictor hormone (angiotensin II) and deficiency of a renal vasodilator (bradykinin) may be etiologic in the pathogenesis of HR syndrome.

4172 THE DIAGNOSIS OF THE SITE OF UPPER GASTROINTESTINAL HAEMORRHAGE IN PATIENTS WITH ESTABLISHED PORTAL HYPERTENSION. (Eng.) Mitchell, C. J.; Jewell, D. P. (St. James' Hosp., Leeds LS9 7TF, England). *Endoscopy* 9(3):131-135; 1977.

The findings of 75 endoscopies performed in 60 patients known to have esophageal varices and who presented with further upper gastrointestinal hemorrhage during the previous 72 hr are presented. A site of active bleeding was found at 50 of the 75 examinations. Endoscopy was performed within 3 hr of the last bleeding episode in 21 patients, and the site of hemorrhage was detected in all of them. The bleeding site was determined in only four of eight patients who were endoscoped 24-48 hr after hemorrhage. Variceal bleeding alone was seen in 40 of these 50 examinations, while only six patients were bleeding from mucosal lesions alone. Both varices and mucosal lesions were bleeding in four patients. An adult end-viewing duodenoscope was used in 45 endoscopies, and bleeding from esophageal varices restarted during the procedure in three patients; one patient remained unconscious for 24 hr following i.v. diazepam administration. A pediatric endoscope was used for 30 examinations, and a full examination was achieved in each patient. No sedation was required, and the procedure was free of complications. The pediatric endoscope is regarded as the instrument of choice for patients known to have portal hypertension and who present with upper gastrointestinal hemorrhage.

4173 PORTAL HYPERTENSION AND TRANSHEPATIC EMBOLISATION OF GASTRO-OESOPHAGEAL VARICES. (Eng.) Casselden, P. A. (Royal Free Hosp., London, England). *Radiography* 43(514): 223-228; 1977.

The pathology of portal hypertension is outlined together with the formation and treatment of gastro-esophageal varices. Portal hypertension is invariably caused by an obstruction of the portal vein somewhere along its course and may anatomically be classified into pre- and postsinusoidal intra- and extrahepatic obstruction. When the portal circulation is obstructed either extra- or intrahepatically, it is normal to find the development of a collateral circulation carrying portal blood to the systemic veins. The treatment of esophageal and gastric varices may be accomplished by the following procedures: blood transfusion; the administration of vasopressin to lower the portal pressure; the insertion of a Sengstaken tube and balloon; surgical intervention that includes localized devascularization of the varices, portasystemic shunts, and subcardiac porta-azygos disconnection; obliteration of varices by esophagoscopy; and transhepatic portography. Transhepatic portography together with the selective catheterization of esophageal and gastric varices has been developed with encouraging short-term results. Although embolization of varices does not cure portal hypertension and is not the ideal treatment since further collateral veins may form, the flow in existing veins is interrupted, and it is hoped that the blood will pass through other veins less prone to bleeding, e.g., the renal vein. Patients selected for embolization of varices all have a history of extensive hemorrhage and are considered at high risk with poor operative and postoperative prognosis. The only contraindications to this technique appear to be excessive bleeding, hepatic mass, or hydatid disease. Although no control series has been completed for selective catheterization and obliteration of bleeding varices, all cases that have been followed with transplenic venography reveal that the portal vein is patent and that the majority of successfully embolized varices remain thrombosed. The longest follow-up to date is 1 yr, and no further hemorrhaging has occurred in this patient.

4174 OPERATIVE RESULTS IN PORTAL HYPERTENSION WITH BLEEDING OESOPHAGEAL VARICES. (Eng.) Bergan, A.; Flatmark, A. (Natl. Hosp. Norway, Univ. Clinic, Oslo, Norway). *Scand. J. Gastroenterol.* 12(6):677-682; 1977.

The results of surgery in 81 patients who were treated during a 15-yr period for bleeding esophageal varices complicating portal hypertension are presented. Nearly 90% had liver cirrhosis, and 21% were alcoholics. Sixty-seven portasystemic shunts were performed in 63 patients; 11 of these were emergency procedures. The overall operative mortality in electively shunted patients was 10.7%. Even in those with the most severe liver insufficiency (child's group C), operative mortality was below 20%. Operative mortality in the elective cases was closely correlated to peroperative bleeding. Only 1 of 45 patients needing less than 10 units of blood peroperatively died, while mortality in the multitransfused group was 45.5%. Both patients who survived urgent shunt surgery were operated on early, i.e., before they had received 5 units of blood each.

4175 CIRRHOTIC PORTAL HYPERTENSION: MORBIDITY OF CONTINUED ALCOHOLISM. (Eng.) Pande, N. V.; Resnick, R. H.; Yee, W.; Eckardt, V. F.; Shurberg, J. L. (Lemuel Shattuck Hosp., 170 Morton St., Boston, MA 02130). *Gastroenterology* 74(1):64-69; 1978.

The morbidity of continued alcoholism was examined in 172 cirrhotic patients who had been randomized for participation in controlled trials of portacaval shunts. Of 159 patients surviving more than 30 days, 76 continued drinking (group A), 68 abstained (group B), and 15 (group C) were chronically institutionalized (without potential access to alcohol). The mean number of days in hospital (post-randomization) and the prevalence of bleeding varices, ascites, and encephalopathy were similar for groups A and B ($p>0.05$ for each comparison). Jaundice at hospital readmission, however, occurred in 50% of group A but in only 28% of group B ($p<0.01$). Mortality and complication rates were substantially greater in group C than in groups A or B, emphasizing the significance of progressive liver disease in institutionalized patients. Although continued alcoholism was associated with recurrent jaundice, a major impact on other criteria of morbidity was not demonstrated.

4176 LOWER ESOPHAGEAL SPHINCTER FUNCTION IN CIRRHOSIS. (Eng.) Nebel, O. T. (530 Lomas Santa Fe Drive, Solana Beach, CA 92075). *Am. J. Dig. Dis.* 22(12):1101-1105; 1977.

Lower esophageal sphincter (LES) function in cirrhosis was evaluated in 10 cirrhotic patients without ascites, 5 cirrhotic patients with ascites, and 10 controls using an infused manometric system. LES pressure (LESP) in the subjects with cirrhosis (22 + 1 mm Hg) was not significantly ($p>0.05$) different from that of the control subjects (21 ± 1 mm Hg) but was significantly ($p<0.01$) greater than the LESP in the subjects with cirrhosis and ascites (16 ± 2 mm Hg). There was no significant difference in LES response to i.v. pentagastrin, i.v. edrophonium (80 µg/kg), or straight-leg raising in the three groups. After loss of ascitic fluid, LESP significantly ($p<0.01$) increased change in pressure ($\Delta P=9 \pm 3$ mm Hg) and gastric pressure (GP) significantly ($p<0.01$) decreased ($\Delta P=8 \pm 2$ mm Hg). The changes in LESP and GP revealed a significant ($r=0.83$, $p<0.001$) linear correlation. These data indicate that cirrhosis is associated with normal LES function, and that the mechanism of lowered LESP with ascites may be the inability of the LES to maintain a sustained response to chronic increases in GP.

4177 INCIDENCE OF LIVER CIRRHOSIS IN 16 AREAS OF THE U.S. [Abstract]. (Eng.) Garagliano, C. F.; Mendeloff, A. I.; Lilienfeld, A. M. (Dept. Epidemiology, Johns Hopkins Univ., Baltimore, MD). *Gastroenterology* 72(5, Part 2):1060; 1977.

4178 SUBCLINICAL HEPATIC ENCEPHALOPATHY: DETECTION, PREVALENCE, AND RELATIONSHIP TO NITROGEN METABOLISM [Abstract]. (Eng.) Rikkers, L.; Jenko, P.; Rudman, D.; Freides, D. (Emory Univ. Sch. Medicine, Atlanta, GA). *Gastroenterology* 72(5, Part 2):1119; 1977.

4179 DOES PORTAL HYPERTENSION CONTRIBUTE TO THE FEMINIZATION OF ALCOHOLIC MEN [Abstract]? (Eng.) Van Thiel, D. H.; Gavaler, J. S.; Slone, F.; Smith, W. I., Jr.; Lester, R.. (Dept. Medicine, Univ. Pittsburgh, Pittsburgh, PA). *Gastroenterology* 72(5, Part 2):1144; 1977.

See also, 3695, 3844, 3847, 4085, 4087, 4104, 4109, 4110, 4136, 4147, 4149.

LIVER AND BILIARY TRACT

Gallbladder and Biliary Tract Diseases

4180 ENDOSCOPIC RETROGRADE CHOLANGIOGRAPHY (ERC) IN SURGICAL EMERGENCIES. (Eng.) Safrany, L.; Van Husen, N.; Kautz, G.; Wittrin, G.; Clemens, M.; Weitemeyer, R. (Reinhard-Nieter-Krankenhaus, 2940 Wilhelmshaven, W. Germany). *Arm. Surg.* 187(1):20-23; 1978.

The cases of 12 patients, presenting with an acute abdomen of suspected biliary tract origin, who underwent endoscopic retrograde cholangiography (ERC) are discussed, and 6 cases are presented. Eight patients had either traumatic, spontaneous, or postoperative biliary tract fistulas with five leading to the peritoneal cavity, one to the colon, one to the bronchial tree, and one to the liver parenchyma from a ruptured gallbladder. Each was confirmed by ERC. Four patients with jaundice following traumatic rupture of the liver had a pathological communication between the intrahepatic biliary tracts and the hepatic vascular system. It is concluded that ERC is a reliable method for obtaining precise localization of biliary tract problems in surgical emergencies both pre- and postoperatively.

4181 BILIARY ATRESIA: HISTOPATHOLOGIC OBSERVATIONS AND REFLECTIONS UPON ITS NATURAL HISTORY. (Eng.) Bill, A. H.; Haas, J. E.; Foster, G. L. (Children's Orthopedic Hosp. and Medical Center, 4800 Sand Point Way, Seattle, WA 98105). *J. Pediatr. Surg.* 12(6):977-982; 1977.

To investigate the etiology of biliary atresia, operative liver biopsies and specimens of the extrahepatic ducts and porta hepatis were studied in 12 cases of biliary atresia. In all cases, the liver showed giant cell transformation and inflammation with mononuclear cells and neutrophils. Most had other features of neonatal hepatitis, including hepatocyte necrosis. In the intrahepatic bile ducts of all but one case, in the hepatic ducts and glands at the porta hepatis, and in the extrahepatic ducts where epithelium remained, there was degeneration of the epithelium and intramural inflammation. In the ducts at the porta hepatis and in six of eight extrahepatic ducts where epithelium remained, there was extensive mural fibrosis compromising the diameter of the duct lumens. Three cases showed the inflammatory changes distal to sites of closure of

the extrahepatic ducts. These findings demonstrate that hepatitis, intrahepatic cholangitis, and sclerosing cholangitis of the extrahepatic ducts all interact to produce acquired obstruction to bile flow in biliary atresia.

4182 SONOGRAPHIC "PARALLEL CHANNEL" SIGN OF BILIARY TREE ENLARGEMENT IN MILD TO MODERATE OBSTRUCTIVE JAUNDICE. (Eng.) Conran, M. R.; Landay, M. J.; Janes, J. O. (Parkland Memorial Hosp., 5201 Harry Hines Blvd., Dallas, TX 75235). *Am. J. Roentgenol.* 130(2):279-286; 1978.

Minimal dilatations of the biliary system caused by obstruction were diagnosed by recognition of the "parallel channel" signs that are based on the concomitant imaging of the right and left main portal vein branch and the adjacent main hepatic duct. Eighty-six patients with jaundice or an elevation of the bilirubin level of less than 11.0 mg/100 ml were studied prospectively for 10 months. Ultrasound parallel channel signs were best demonstrated on transverse sections in the supine position. Each ultrasound diagnosis of dilated bile ducts was considered a true positive only when confirmed by surgery, percutaneous transhepatic cholangiography, or retrograde endoscopic cannulation. Obstructive jaundice was correctly diagnosed with the parallel channel sign in 27 patients. The lowest bilirubin value at which the sign was positive was 1.5 mg/100 ml. Nonobstructive jaundice was correctly diagnosed in 44 patients. There were three false-negative diagnoses in which the sign was not present despite obstruction and elevated bilirubin. There were no false-positive cases. Five case reports are presented, one of which demonstrated that, without parallel channel sonography, an incorrect diagnosis would have been made. Parallel channel sign is a simple method for the accurate differentiation between obstructive and nonobstructive jaundice when there is mild to moderate elevation of the bilirubin level.

4183 BILIARY PANCREATIC REFLUX DURING PEROPERATIVE RADIOMANOMETRY. (Eng.) Yvergneaux, J. P.; Bauwens, E.; Yvergneaux, E. *In: The Sphincter of Oddi. Proceedings of the Third Gastroenterological Symposium, Nice, June 8, 9, 1976.* (S. Karger: Basel): 80-85; 1977.

Peroperative transcystic radiomanometries of 100 gallbladder patients with strict, normal, manometry (no hypertony and no hypotony) and 424 patients without jaundice or malignant pathology of the biliary tree who had either normal, hypotonic, or hypertonic manometry were studied to analyze pancreatic reflux (WR). In the gallbladder patients, WR was more frequent in those over 60 yr ($p<0.005$) and increased in incidence with rising perfusion pressure, increasing flow rate, or occurrence of sphincter hypotony. There was a significant increase in the diameter of the duct of Wirsung with increasing age (from 2.2 ± 0.24 mm at <40 yr to 3.3 ± 0.23 mm at >60 yr, $p<0.001$). Only absence or congenital atrophy of the duct of Wirsung excluded WR. WR appears at minimal opening pressure ($p<0.001$) and quickly becomes total when the papillar channel is more developed than the infundibulum of the common bile duct or when the infundibulum of the common duct is undersized compared to the common channel. The most common anatomical channel joined at an acute angle by the two arms of the papilla, forming a "Y" figure, and WR appeared at a pressure higher than minimal. In the patients without jaundice or malignant pathology, WR is rarer in hypertony (37.5%) than in normotony and hypotony (52%, $p<0.025$); it appeared mostly during perfusion or marked hyperpression (72%, $p<0.005$). In residual pancreatitis, WR is short and never total. In benign Oddian stenosis, WR is rarer than normal (32%, $p<0.001$) and short, with a large Wirsungian caliber (4 ± 0.3 mm) that is significantly ($p<0.005$) larger than in patients of the same age with normal manometry. The results show that increased pressure on Wirsung's duct by physiologic (e.g., fatty meal) or pathologic (e.g., benign papillary stenosis) conditions may decrease WR.

4184 CHOLEDOCHODUODENOSTOMY AS AN ADJUNCT TO CHOLEDOCHOLITHOTOMY. (Eng.) Schein, C. J.; Shapiro, N.; Gliedman, M. L. (Albert Einstein Coll. Medicine, New York, NY). *Surg. Gynecol. Obstet.* 146(1):25-32; 1978.

The indications for and results of choledochoduodenostomy in 100 patients operated for calculus related disease of the common bile duct are reported. There were no significant early or late complications of the anastomotic procedure. The 3% mortality was related to antecedent advanced liver disease in two instances and, in one instance, to intra-abdominal sepsis. The surgical bypass had the advantage of circumventing the retained stone problem or the sequelae of benign obstructive disease in the distal part of the choledochus. It permits postoperative roentgenographic and endoscopic evaluation of the anastomotic site. Cholangitis, blind segment disability, and malfunction have not been seen with these indications and this technique. When the common bile duct is at least 1.4 cm wide, primary or secondary choledochoduodenostomy with a wide anastomosis has significant advantages over T-tube intubation in the therapeutic and prophylactic management of choledocholithiasis.

4185 ENDOSCOPIC PAPILLOTOMY. (Eng.) Koch, H.; Rosch, W.; Schaffner, O.; Demling, L. (Medizinische Universitatsklinik, Krankenhausstrasse 12, D-8520 Erlangen, W. Germany). *Gastroenterology* 73(6):1393-1396; 1977.

Experience with endoscopic electrosurgery in the treatment of common bile duct obstruction in 267 patients is reviewed. In 192 of 222 patients with choledocholithiasis, all calculi were evacuated by endoscopic papillotomy (EP). The remaining patients had EP because of papillary stenosis. Complications of EP included nine instances of pancreatitis, seven of bleeding, and two perforations. In 2 of 32 patients having EP for papillary stenosis, steno-

sis has reappeared on follow-up. The two fatalities were attributable to purulent cholangitis and acute bleeding. This complication rate is less than that reported for the traditional surgical procedures required to manage these situations. The endoscopic method requires less hospitalization and recuperation. EP and stone extraction are the methods of choice for managing common duct obstruction in high risk patients before cholecystectomy, for retained or reformed stones after cholecystectomy, and for papillary stenosis.

4186 ANAEROBES IN HUMAN BILIARY TRACTS. (Eng.) England, D. M.; Rosenblatt, J. E. (Wiesbaden U.S. Air Force Hosp., APO, New York, NY 09330). *J. Clin. Microbiol.* 6(5):494-498; 1977.

Aerobic and anaerobic microorganisms were studied in bile cultures from 371 patients who underwent biliary tract surgery during a 2-yr period. Sixty-nine percent of the cultures were positive, and 41% of these grew anaerobes, although they were present in pure culture only twice. Mixed cultures most commonly contained four different organisms (3 aerobes and 1 anaerobe). *Bacteroides fragilis* was the single most commonly isolated anaerobe and ranked fourth in terms of overall isolates behind *Escherichia coli*, group D streptococci, and *Klebsiella*. *B. fragilis* accounted for 7.0% of the total aerobic and anaerobic isolates and was present in 21% of all positive cultures. *Pseudomonas aeruginosa* and *Clostridium perfringens* ranked fifth and sixth, providing 6.5% and 5.9% of all isolates, resp. This study demonstrates the frequent presence of anaerobes in patients with bactibilia and suggests that these organisms be considered in the formulation of antimicrobial therapy for infections involving human biliary tracts.

4187 ELECTRON PROBE MICROANALYSIS IN THE STUDY OF GALLSTONES. (Eng.) Been, J. M.; Bills, P. M.; Lewis, D. (Dept. Chemical Physics, Univ. Surrey, Guildford, Surrey, England). *Gut* 18 (10):836-842; 1977.

The structure and composition of gallstones were studied using an electron probe microanalyzer in conjunction with other methods. Gallstones were studied layer by layer without greatly disturbing the arrangement of the materials present. Elements, including trace elements such as copper, iron, and manganese, were identified and their distributions mapped. The range of the method was extended to determine the character and distribution of certain chemical groups present by treating sections of gallstone with reagents that contained easily detected elements. The nature of the bonding of the sulfur in the stones was studied by examining the sulfur x-ray spectrum. Pigmented sulfur-containing deposits were found to contain sulfur in a low valence state, but taurine conjugates and the sulfate groups of mucosubstances were not detected. Microcrystalline apatite present in the stones contained some manganese and seemed to be implicated in the adsorption of the low valence sulfur compound and in the nucleation of some stones.

4188 THE REMOVAL OF RETAINED BILIARY TRACT STONES: REPORT OF 105 CASES. (Eng.) Garrow, D. G. (Vancouver General Hosp., Vancouver, British Columbia, Canada). *Br. J. Radiol.* 50(599): 777-782; 1977.

The results of treating 105 cases of retained biliary tract stones are reported. The removal of retained biliary stones was achieved by the use of a steerable catheter and wire basket after T-tube removal. Filling the T-tube tract with contrast after removal of the T-tube made introduction of the catheter much easier and reduced the hazard of tract perforation. Coating the wire Dormia basket with K-Y Jelly or silicone greatly reduced friction between the basket and the lumen of the Burhenne catheter used. In cases where there was doubt about the presence of stones or portions of stones within the duct system after an attempted removal, a urethral catheter was used to keep the tract open, and a cholangiogram was repeated in 48 hr. A total of 115 catheterizations were performed in the 105 patients, with 10% of the patients having more than one catheterization. There were six failures, six complications, and no deaths. Multiple stones were found in 27 patients, and 11 patients had only debris within the duct (no stone actually removed). The complications included rupture of the T-tube tract in two patients, cholangitis in three patients, and a large subhepatic bile collection 3 months after stone removal in one patient.

4189 FEASIBILITY OF LOW-DOSE AND INTERMITTENT CHENODEOXYCHOLIC ACID THERAPY OF GALLSTONES. (Eng.) Marks, J. W.; Bonorris, G. G.; Chung, A.; Coyne, M. J.; Okun, R.; Lachin, J. M.; *et al.* (Cedars-Sinai Medical Center, 8700 Beverly Blvd., Los Angeles, CA 90048). *Am. J. Dig. Dis.* 22(10):856-860; 1977.

The feasibility of low-dose and intermittent chenodeoxycholic acid therapy was assessed in 18 patients with gallstones by studying the induction and persistence of chenodeoxycholic acid-induced biliary lipid changes. Biliary lipid composition with each of three doses of chenodeoxycholic acid was determined in bile samples obtained by cholecystokinin-stimulated duodenal drainage before, after 1 week and 1 month of treatment, and up to 9 weeks after discontinuation of treatment. The lowest dose that significantly reduced the relative concentration of biliary cholesterol was 250 mg/day. A significant reduction occurred 1 week after initiation of treatment ($p<0.05$) and was maintained for 9 weeks following discontinuation of treatment. Thus, clinical trials of low-dose and intermittent chenodeoxycholic acid therapy for gallstone prophylaxis or dissolution are warranted.

4190 PRIMARY COMMON DUCT STONES. (Eng.) Saharia, P. C.; Zuidema, G. D.; Cameron,

J. L. *In: Transactions of the Southern Surgical Association Eighty-Eighth Annual Meeting Held at the Breakers, Palm Beach, Florida, December 6, 7, 8, 1976.* (Philadelphia: J. B. Lippincott Co.): 88: 101-105; 1977.

Clinical presentation, operative findings, surgical treatment, and long term follow-up results are reported in 30 patients with primary common duct stones. Criteria for diagnosis included at least a 2-yr symptom free interval following cholecystectomy; soft, light brown stones or sludge present in the common duct; and the absence of a long cystic duct remnant or a biliary stricture from the previous surgery. The average age of the patients was 66 yr. The interval between cholecystectomy and the diagnosis of primary common duct stones averaged 12 yr. Acute cholangitis was a frequent mode of presentation. At the time of surgery the bile duct was often dilated out of proportion to the serum bilirubin. In only 1 of the 30 patients was ampullary stenosis present. Twenty-six patients had only stone extraction and insertion of a T tube for treatment of their primary common duct stones. Twenty-two of the 26 were followed for an average of 4 yr and 9 months with no evidence of recurrent stones in 18. Four developed recurrent primary common duct stones 1, 5, 5, and 7 yr later. It is concluded that most patients with primary common duct stones do well after stone extraction alone.

4191 INFLUENCE OF CHOLIC AND CHENODEOXYCHOLIC ACID ON BILIARY CHOLESTEROL SECRETION IN MAN. (Eng.) Lindblad, L.; Lundholm, K.; Schersten, T. (Sahlgrenska sjukhuset, S-413 45 Goteborg, Sweden). *Eur. J. Clin. Invest.* 7(5):383-388; 1977.

The interrelationships between biliary bile acid, lecithin, and cholesterol secretion rates were studied during depletion of the bile acid pool and during duodenal administration of cholic or chenodeoxycholic acid in 13 patients 7-12 days after operation for uncomplicated gallstone disease. The mean lecithin secretion rate was significantly higher during cholic acid than during chenodeoxycholic acid infusion (0.45 ± 0.03 versus 0.30 ± 0.03 μmol lecithin/μmol bile acid, $p<0.01$). The relationship between bile acid and cholesterol secretion rates was curvilinear during bile acid pool depletion and during duodenal cholic acid infusion, fitting an equation [$y=x/(a + bx)$] that is the same function found in Michaelis-Menten enzyme kinetics. At low bile acid secretion rates, during bile acid pool depletion and during cholic acid infusion, the lecithin secretion rate was significantly correlated ($r=0.80$, $r=0.70$, and $r=0.86$, resp.) to the cholesterol secretion rate. The bile acid and cholesterol secretion rates were not significantly correlated during chenodeoxycholic acid infusion. However, under this experimental condition, a significant ($r=0.50$) curvilinear relationship between lecithin and cholesterol secretion rates was found. The hepatic bile became unsaturated in cholesterol at significantly lower bile acid secretion rate during mainly chenodeoxycholic acid infusion (10.7 ± 0.3 μmol/min) than during mainly cholic acid infusion (15.6 ± 0.5 μmol/min, $p<0.001$).

4192 ELEVATIONS IN SKIN TISSUE LEVELS OF BILE ACIDS IN HUMAN CHOLESTASIS: RELATION TO SERUM LEVELS AND TO PRURITUS. (Eng.) Ghent, C. N.; Bloomer, J. R.; Klatskin, G. (Yale Univ. Sch. Medicine, 333 Cedar St., New Haven, CT 06510). *Gastroenterology* 73(5):1125-1130; 1977.

To define the relationship of bile acid retention to the pruritus of cholestasis, individual bile acids in serum, in acetone swabs of skin, and in skin tissue were quantified in 13 patients with cholestasis undergoing laparotomy and in 8 controls. There was no consistent relationship between pruritus and concentrations of either total or individual bile acids in serum. Skin tissue concentrations of bile acids were elevated in patients with cholestasis, were linearly related to serum levels, and did not differentiate between those patients with and those without pruritus. Concentrations of bile acids on the skin surface, which were lower than those reported by others (2.7 ± 2.0, 4.5 ± 1.0, and 2.1 ± 1.0 μg/750 cm^2 for patients with pruritus and cholestasis, patients with cholestasis alone, and controls, resp.), did not correlate with pruritus and were decreased by simple soap and water washing. These data indicate that the pruritus of cholestasis is not directly related to the skin tissue concentration of any of the major bile acids, although a relationship to a particular molecular form of bile acids could not be excluded.

4193 UNCONJUGATED BILIRUBIN, AND THE HYDROLYSIS OF CONJUGATED BILIRUBIN, IN GALLBLADDER BILE OF PATIENTS WITH CHOLELITHIASIS. (Eng.) Boonyapisit, S. T.; Trotman, B. W.; Ostrow, J. D. (Siriraj Hosp., Mahidol Univ., Bangkok 7, Thailand). *Gastroenterology* 74(1):70-74; 1978.

To assess the role of hydrolysis of conjugated (CB) to unconjugated (UCB) bilirubin in pigment gallstone formation, 52 samples of human gallbladder bile were aspirated at laparotomy. In each bile sample, the concentrations of CB and UCB were determined, using a new thin layer chromatographic method, and the rate of hydrolysis of CB to UCB was measured during incubation at 37 C, performed under nitrogen and in the dark to prevent oxidation of the bile pigments. Nine control biles without gallstones contained no more than 1.87 mg/dl of UCB (<1.2% of total bilirubin), and showed no significant hydrolysis of CB to UCB. Among 24 biles containing cholesterol gallstones, only 3 showed significant hydrolysis of CB, and only 1 of these exhibited increased concentrations of UCB. By contrast, 10 of 19 biles containing pigment precipitates or gallstones revealed increased concentrations of UCB and/or significant hydrolysis of CB to UCB. Biles containing pigment calculi were best distinguished by their supersaturation with the poorly soluble, nonionized form of UCB at the mea-

sured bile acid concentration of each sample. Total bilirubin concentrations were not elevated except in four of the five biles containing pigment precipitates. Among 15 biles cultured both aerobically and anaerobically, only 2 grew any bacteria (*Escherichia coli*), and there was no relation between the presence of bacteria and hydrolysis of CB to UCB. It is concluded that some UCB is normally secreted into bile, and that hydrolysis of CB and excessive concentrations of UCB, especially its nonionized form, are associated with pigment gallstones, although related to factors other than bacterial infection.

4194 NON CALCULOUS CHOLECYSTITIS: AN 8 YEAR REVIEW OF CASES TREATED BY ELECTIVE CHOLECYSTECTOMY. (Eng.) Jones, A. G.; Blair, D. W. (Royal Infirmary, Aberdeen, Scotland). *Scott. Med. J.* 23(1):27-31; 1978.

Thirty-six cases of acalculous cholecystitis (found in a total of 248 cases of cholecystectomy) are reviewed with regard to signs, symptoms, and radiological investigations. The patients had suffered discomfort that lasted from 5 days to 34 yr, and during this time 66 cholecystograms were performed in 32 of these subjects. Persistently negative x-ray examinations were observed in 18 patients, while poor function of the gallbladder was demonstrated in 10. Of 66 gallbladder visualizations, 4 showed stones; 3 of these were false positives, while one showed a common duct stone that was confirmed at operation. Of 42 barium examinations on 25 of the patients, 38 were negative, 2 showed hiatal hernia, 1 showed duodenal diverticula, and 1 showed paraesophageal hiatal hernia plus duodenal diverticula. Gallbladders of all patients with acalculous cholecystitis revealed some abnormalities at surgery. Histological examination showed chronic cholecystitis (7 cases), one being thick-walled with a rupture at the tip and pyogenic granulations. One showed chronic cholesterosis. The remainder showed variable degrees of chronic inflammation. The majority of specimens also had very thickened and, in some cases, fibrosed gallbladder walls. Nineteen patients had some postoperative complications, mainly chest (9) and urinary (8) tract infections, wound infection (6), and pneumonia (4). One 80-yr-old patient died of a pulmonary embolus. The majority of the patients (29) were symptomless within 2 months after surgery; in two other cases, symptoms disappeared in 5 and 12 months, resp. Four subjects had postoperative symptoms related to the pre-operative ones, and one had new symptoms. Patients with recurrent attacks of cholecystitis should be considered for cholecystectomy despite repeatedly negative radiological examinations.

4195 DIAGNOSIS AND MANAGEMENT OF POST-CHOLECYSTECTOMY SYMPTOMS: THE PLACE OF ENDOSCOPY AND RETROGRADE CHOLEDOCHOPANCREATOGRAPHY. (Eng.) Blumgart, L. H.; Carachi, R.; Imrie, C. W.; Benjamin, I. S.; Duncan, J. G. (Glasgow Royal Infirmary, Glasgow, Scotland). *Br. J. Surg.* 64(11): 809-816; 1977.

The value of endoscopic retrograde choledochopancreatography (ERCP) in the diagnosis and management of postcholecystectomy symptoms was assessed in 52 patients symptomatic after cholecystectomy in whom barium meal studies and i.v. cholangiography had failed to yield a diagnosis. Cannulation of the papilla of Vater was carried out in 50 of the patients in a mean time of 10 min. Diagnostic information demonstrating a pathological lesion or a normal biliary and pancreatic ductal system was obtained by endoscopy and ERCP in 48 cases. There were no serious complications. A pathological lesion was demonstrated in all but one of the patients presenting with jaundice, cholangitis, or pancreatitis, but the diagnostic yield was not as high in patients with vague upper abdominal symptoms. Endoscopy and ERCP are the investigative procedures of choice in complex postcholecystectomy patients in whom i.v. cholangiography either fails, gives incomplete information, or is false-negative despite continuing symptoms or clinical evidence of residual biliary disease.

4196 MULTIPLE GALLBLADDERS. (Eng.) Harlaftis, N.; Gray, S. W.; Skandalakis, J. E. (Emory Univ. Sch. Medicine, Atlanta, GA). *Surg. Gynecol. Obstet.* 745(6):928-934; 1977.

Two hundred seven reports in the literature of double gallbladder and eight of triple gallbladder are reviewed. Multiple gallbladders form a continuous spectrum of malformation, from an externally normal gallbladder with an internal longitudinal septum to the most widely separated accessory gallbladders. Although multiple gallbladders are found more frequently in women than in men, the authors believe that the duplication occurs about equally in men and women and that the difference is in the frequency of gallbladder disease and hence in the frequency of discovery of the anomaly. When disease is present, both organs are usually affected if they are intimately connected. When separation is complete and each organ has its own cystic duct, it is not unusual to find one healthy and one diseased gallbladder. Cholecystography remains the best means for preoperative diagnosis of multiple gallbladders, but it is most effective with healthy gallbladders. In about 69% of surgically confirmed instances of duplication, the preoperative cholecystogram failed to reveal the duplication. Hence, abnormal films are diagnostic, and normal films do not rule out duplication. Operative cholangiography should be used in all doubtful instances. Symptomatic multiple gallbladders require cholecystectomy. All cystic structures should be removed. In elderly or debilitated patients, cholecystostomy should be considered. Multiple gallbladders without symptoms should be left alone.

4197 JAUNDICE AND HEPATITIS B SURFACE ANTIGEN AND ANTIBODY IN GREEK HAEMOPHILIACS. (Eng.) Yannitsiotis, A.; Bossinakou, I.; Louizou, K.; Panayotopoulou, C.; Mandalaki, T. (51 Homirou

str., Athens, 135, Greece). *Scand. J. Haematol.* (Suppl. 30):11-15; 1977.

The incidence of hepatitis B surface antigen (HBsAg) and antibody (HBsAb), and of abnormal liver function, in 101 Greek multitransfused hemophiliacs with or without a previous history of jaundice was studied. Using the hemagglutination inhibition assay, HBsAg was detected in 9.9%, HBsAb in 61.3%, and HBsAg plus HBsAb in 11.8% of the patients. The incidence of jaundice was 14.8%. Liver function was tested by means of Normotest, SGOT, SGPT, and serum protein electrophoresis; abnormal values were found in 47% of the patients. The abnormal findings were related to the presence of HBsAg or HBsAb and to the history of jaundice. There was no significant difference between the various groups of patients.

4198 BILIARY BACTERIA AND HEPATIC HISTOPATHOLOGIC CHANGES IN GALLSTONE DISEASE. (Eng.)
Flinn, W. R.; Olson, D. F.; Oyasu, R.; Beal, J. M. *In: Transactions of the Southern Surgical Association Eighty-Eighth Annual Meeting held at the Breakers, Palm Beach, Florida, December 6, 7, 8, 1976.* (Philadelphia: J. B. Lippincott): 88:101-105; 1977.

The frequency and severity of liver damage in 126 patients with gallstone disease and the role of bacteria in the development of these changes were assessed. Needle biopsy of the liver demonstrated acute inflammation of portal triads in 19 of the patients with gallstones, a finding not present in the 26 control patients. Acute inflammation occurred more often in patients with acute cholecystitis and choledocholithiasis than in chronic cholecystitis. Cultures of the biliary tract or liver were positive in 23 of 64 patients. The frequency of positive bile cultures increased with the severity of the biliary tract disease. Five of six positive liver cultures were from patients with acute cholecystitis or choledocholithiasis. The data suggest that impairment of bile flow is responsible for the acute hepatic inflammatory changes.

4199 CHOLELITHIASIS AND WILSON DISEASE. (Eng.)
Rosenfield, N.; Grand, R. J.; Watkins, J. B.; Ballantine, T. V. N.; Levey, R. H. (Harvard Medical Sch., Boston, MA). *J. Pediatr.* 92(2):210-213; 1978.

Clinical data is presented on three children with Wilson's disease who had symptoms suggestive of cholecystitis as well as radiologic evidence of gallstones, which were subsequently proven at the time of laparotomy. The gallstones from the patients with Wilson's disease had an appreciably higher content of cholesterol than gallstones from age-matched children with hemolytic disease. Since gallstones may be present for years before they produce clinical symptoms, young patients with Wilson's disease should undergo routine investigation for the presence of stones; cholelithiasis should also be considered in the differential diagnosis of abdominal pain in such patients.

4200 SPHINCTEROTOMY OF ODDI'S SPHINCTER. (Eng.)
Mentouri, B. *In: The Sphincter of Oddi. Proceedings of the Third Gastroenterological Symposium, Nice, June 8, 9, 1976.* (S. Karger: Basel): 190-195; 1977.

To study the effectiveness of sphincterotomy of Oddi's sphincter as a treatment for lithiasis of the common bile duct (CBD), 483 sphincterotomies performed between 1963 and 1975 were studied. The sphincterotomies were indicated for reasons of necessity in 302 cases (impacted stone in 84, removal by upper route impossible in 130, odditis in 73, and pancreatitis plus impacted stone in 15) and for reasons of security (where the aim is to carry out internal drainage of the CBD) in 176 cases (multiple stones in 61, biliary deposit and cholangitis in 30, lithiasis with one stone in 72, and residual lithiasis in 13); in 5 cases, sphincterotomy was abusive, due to erroneous interpretation of the x-ray picture of the lower CBD. Morbidity concerning sphincterotomy occurred in 34 cases (postoperative pancreatitis, 14; duodenal fistula, 5; subphrenic abscess, 7; cholangitis, 3; hemorrhage, 5) and in 11 cases not connected with sphincterotomy for an overall morbidity rate of 9.2%. There were 21 deaths connected with sphincterotomy, due to acute postoperative pancreatitis (12), subphrenic abscesses (4), duodenal fistulas (2), cholangitis (2), and hemorrhage of sphincterotomy (1). Long-term results in 234 patients were excellent in 163, good in 27, fair in 41, and poor in 3. The study suggests that sphincterotomy is a satisfactory technique, especially with respect to the very few cases of retained stone (1/234). However, postoperative mortality due to pancreatic complications (55% of deaths) suggests that indications for sphincterotomy should be applied in a more eclectic manner.

4201 BENIGN STENOSIS OF THE PAPILLA OF VATER: DIAGNOSIS OF 119 CASES WITH CONVENTIONAL AND SELECTIVE LOW RADIOMANOMETRY. (Eng.)
Yvergneaux, J. P.; Bauwens, E.; Outryve, L. V.; Yvergneaux, E. (President Rooseveltlaan 92, B-9000 Ghent, Belgium). *Acta Chir. Belg.* 76(6):523-532; 1977.

Experience with intraoperative radiomanometry with serial conventional films (panoramic cholangiography) and intra-abdominally placed large dental films (selective low cholangiography) in 2,095 patients with benign biliary pathology is presented. These techniques revealed 119 cases of stenosis of the papilla of which 34 were detected during secondary operations on 85 patients. With this procedure, a clear definition of benign stenosis of the papilla was obtained. The features included: moderate hypertony, disappearance of the normal rhythmical sphincter activity, widening of the biliary infundibulum so that it was wider than the intrapancreatic part of the common bile duct above it, rarity of biliary pancreatic reflux, and enlargement of the pancreatic duct. These signs are characteristic of chronic stasis in both the common bile duct and the pancreatic duct, from the infundibulum to the intrahepatic ducts above the stenotic papilla.

4202 FUNCTION DISORDERS OF THE LIVER, EXTRAHEPATIC BILE DUCTS AND SOME ORGANS OF THE GASTROINTESTINAL TRACT IN ACUTE CHOLECYSTITIS. (Rus.) Shevchenko, V. S. (Dept. Hosp. Surgery, Kiev Medical Inst., Kiev, USSR). *Klin. Khir.* (2):20-25; 1977.

4203 CLINICAL ASPECTS OF ACUTE CHOLECYSTITIS IN ELDERLY PATIENTS. (Rus.) Safronov, A. V. (Clinic General Surgery, Saratov Medical Inst., Saratov, USSR). *Klin. Khir.* (2):26-29; 1977.

4204 ADRENAL CORTEX FUNCTION IN ACUTE CALCULOUS CHOLECYSTITIS IN ELDERLY PERSONS. (Rus.) Ashrafov, A. A. (First Dept. Surgery, N. Narimanov Azerbaidzhan Medical Inst., USSR). *Klin. Khir.* (2): 29-34; 1977.

4205 BRAN, A NEW THERAPEUTIC AGENT. (CONSTIPATION, BILIARY LITHIASIS, DIVERTICULOSIS AND CANCER OF THE COLON). (Fre.) Bargheon, J. (No affiliation given). *Rev. Fr. Gastroenterol.* (126):5-10; 1977.

4206 TREATMENT OF BILIARY LITHIASIS WITH CHENODEOXYCHOLIC ACID. (Fre.) Petite, J. P. (Hopital Broussais, 96, rue Didot, 75674 Paris Cedex 14, France). *Rev. Prat.* 27(12):757-759; 1977.

4207 TREATMENT OF PATIENTS WITH CHOLESTEROL GALLSTONES WITH CHENODEOXYCHOLIC ACID. (Fre.) Guimezanes, A. (Faculte de Medecine Broussais-Hotel-Dieu, France). *Rev. Fr. Gastroenterol.* (126): 49-52; 1977.

4208 POSSIBILITY OF DISSOLVING GALLSTONES USING CHENODEOXYCHOLIC ACID. (Pol.) Bojanowicz, K.; Witkowska, A. (Klinika Gastroenterologiczna, Instytut Medycyny Wewnetrznej AM, ul. Rewolucji 1905 r. 76 m. 1., 90-223 Lodz, Poland). *Pol. Tyg. Lek.* 32(33):1299-1302; 1977.

4209 CALCIUM PALMITATE AND CHOLESTEROL GALLSTONES. (Ger.) Wosiewitz, U.; Wolpers, C. (Univ. Munster, Institut fur Medizinische Physik, Huflerstrasse 68, D-4400 Munster, W. Germany). *Z. Gastroenterol.* 15(5):311-319; 1977.

4210 CONSEQUENCES OF "IDEAL" CHOLECYSTOTOMY WITH CHOLECYSTOJEJUNOSTOMY IN CHOLELITHIASIS. (Rus.) Lys, P. V. (Second Dept. Surgery, Kiev Inst. Advanced Medical Studies, Kiev, USSR). *Klin. Khir.* (2):85-86; 1977.

4211 SPHINCTEROTOMY FOR CHOLEDOCHOLITHIASIS [Letter to Editor]. (Fre.) Bancaud, E. (17, place des Epars, F 28000 Chartres, France). *Nouv. Presse Med.* 6(16):1396; 1977.

4212 CHOLELITHIASIS. (Rus.) Vinogradov, V. V.; Khodzhaeva, M. Kh. (Dept. Surgery, Patrice Lumumba Peoples' Friendship Univ., Moscow, USSR). *Sov. Med.* (2):51-55; 1977.

4213 COMPLICATIONS OF CHOLELITHIASIS. (Ger.) Reismann, B.; Bayer, H. W. (II. Ordinariat fur Chirurgie der Universitat, Ostmerheimer Strasse 200, 5000 Koln 91, W. Germany). *Med. Welt* 28(7):315-320; 1977.

4214 BILE STORAGE AND DISCHARGE IN PATIENTS WITH CHOLELITHIASIS AND IN NORMAL CONTROLS [Abstract]. (Dut.) van Berge Henegouwen, G. P.; Hofmann, A. F. (No affiliation given). *Ned. Tijdschr. Geneeskd.* 121(28):1155; 1977.

4215 CHOLELITHIASIS IN SITUS INVERSUS PARTIALIS ABDOMINALIS. (Ger.) Bohm, S.; Werner, G.; Voigtsberger, P. (Chirurgische Klinik der Medizinischen Akademie, Nordhauser Strasse 74, DDR-50 Erfurt, E. Germany). *Zentralbl. Chir.* 102(14):883-885; 1977.

4216 IATROGENIC GALLSTONE. (Dut.) Standaert, L. (No affiliation given). *Tijdschr. Gastroenterol.* 20(2):113-123; 1977.

4217 HOMOZYGOUS DREPANOCYTOSIS AND CHOLELITHIASIS. (Fre.) Buffet, C.; Missonier, G.; Labayle, D.; Edouard, A.; Etienne, J. P. (Hopital Antoine Beclere, 157, rue de la Porte de Trivaux, F 92141 Clamart, France). *Ann. Med. Interne* 128(3): 281-284; 1977.

4218 BACTERIOLOGICAL STUDY OF BILE IN LITHIASIS: REPORT OF 177 CASES. (Fre.) Grimoud, M.; Izard, G.; Lazorthes, F.; Lemozy, J. (Hopital de Purpan, Place du Docteur Baylac, 31052 Toulouse Cedex, France). *Rev. Fr. Gastroenterol.* (128):47-50; 1977.

4219 HEPATIC HYDATID CYSTS PERFORATING IN THE BILIARY TRACT. (Rus.) Dedenko, I. K. (No affiliation given). *Vestn. Khir.* 118(3):38-40; 1977.

4220 CLINICAL ASPECTS OF EXTERNAL BILIARY FISTULAS. (Rus.) Chalganov, A. I. (No affiliation given). *Khirurgiia (Mosk.)* (3):107-111; 1977.

4221 EXPERIENCE FROM SURGICAL INTERVENTIONS PERFORMED FOR JAUNDICE. (Hun.) Zolnay, B.; Bodrogi, N.; Bende, S. (Semmelweis Korhaz, Sebeszet, Miskolc, Hungary). *Orv. Hetil.* 118(29): 1715-1720; 1977.

4222 THREE PATIENTS WITH "PAINLESS JAUNDICE." (Dut.) de Gruijl, J. (Medische Faculteit der Erasmus Universiteit, Rotterdam, Netherlands). *Ned. Tijdschr. Geneeskd.* 121(28):1121-1123; 1977.

4223 CHOLESTATIC JAUNDICE: ETIOLOGICAL DIAGNOSIS BY MINILAPAROTOMY [Letter to Editor]. (Fre.) Laurent, J.; Vicarf, F.; Jeanpierre, R. E. (G. R. P. D. N., 127, rue St-Dizier, F 54000 Nancy, France). *Nouv. Presse Med.* 6(9):751; 1977.

4224 SIGNIFICANCE OF DETERMINATION OF PANCREATOPEPTIDASE AND HEXOKINASE IN THE BLOOD SERUM IN MECHANICAL JAUNDICE. (Rus.) Podilchak, L. M. (Propedeutic Dept. Internal Diseases, Lvov Medical Inst., Lvov, USSR). *Ter. Arkh.* 49(2):64-66; 1977.

4225 EXPERIENCE IN TREATMENT OF MECHANICAL JAUNDICE. (Rus.) Lys, P. V.; Paratsiy, Z. Z.; Oberemko, B. I. (Second Dept. Surgery, Kiev Inst. Advanced Medical Studies, Kiev, USSR). *Vrach. Delo* (5):32-36; 1977.

4226 PROGNOSTICATION OF POSTOPERATIVE HEPATIC INSUFFICIENCY IN PATIENTS WITH MECHANICAL JAUNDICE. (Rus.) Trofimov, V. M. (S. P. Fedorov Surgical Clinic, S. M. Kirov Military Medical Acad., Leningrad, USSR). *Vestn. Khir.* 118(3):27-31; 1977.

4227 DISTURBED HEMOSTASIS IN MECHANICAL JAUNDICE. (Rus.) Pavlovsky, D. P. (Kiev Oblast Clinical Hosp., Kiev, USSR). *Klin. Med.* 55 (4):74-77; 1977.

4228 PAPILLOMATOSIS OF THE HEPATIC BILE DUCTS: REPORT OF TWO CASES. (Fre.) Chigot, J. P.; Gory, P.; Riquet, M.; Mercadier, M. (No affiliation given). *Rev. Fr. Gastroenterol.* (126):23-25; 1977.

4229 STENOSIS, INSUFFICIENCY AND STENOTIC INSUFFICIENCY OF THE SPHINCTER OF ODDI. (Ita.) Berti Riboli, E.; Mortola, G. P.; Reboa, G.; Pandolfo, N.; De Salvo, L. (Istituto di Clinica Chirurgica Generale e Terapie Chirurgica [B], Univ. Genova, Genova, Italy). *Minerva Gastroenterol.* 23(1):31-34; 1977.

4230 SURGICAL MANAGEMENT OF BILE DUCT STENOSIS BY HEPATICOJEJUNOSTOMY. (Ger.) Simma, W.; Brucke, P. (Allgemeinen Krankenhauses der Stadt Linz, Krankenhausstrasse 9, A-4020 Linz, Austria). *Wien. Med. Wochenschr.* 127(12):403-405; 1977.

See also, 3654, 3667, 3669, 3742, 3844, 3847, 3848, 3854, 3855, 3858, 3875, 3877, 3886, 3895, 3898, 3899, 3900, 3939, 4084, 4170, 4231.

GENERAL

4231 EFFECTS OF INTERMITTENT AND CONTINUOUS FEEDING ON BILIARY LIPID SECRETION IN MAN. (Eng.) von Bergmann, K.; Mok, H. Y. I.; Grundy, S. M. *In: Bile Acid Metabolism in Health and Disease. Proceedings of the IV Bile Acid Meeting, Basel, Switzerland, 11-12 October, 1976.* (Baltimore, Md.: University Park Press): 191-196; 1977.

The effects of continuous versus intermittent feeding was compared by measuring hourly outputs of biliary lipids in 9 patients and by determining bile acid and cholesterol absorption in 23 and 28 patients, resp. The determinations were made in both obese and nonobese patients, in some with mild hyperlipidemia, and in three with alcoholic cirrhosis. Biliary lipid output, measured in mg/hr, was very similar for continuous and intermittent feeding (cholesterol, 46 and 48, resp.; bile acids, 769 and 794, resp.; phospholipids, 308 and 304, resp.). Total bile acid absorption by the intestine in all subjects was 97.5%. There were no significant differences among the various types of patients. Cholesterol absorption was 60%, with no significant differences for the different groups. These findings indicate that similar results are obtained for average hourly secretion rates of biliary lipids whether the diet is given continuously into the duodenum or is fed p.o. as three meals a day. Thus, studies carried out by the two methods should be comparable, provided other aspects in the methodology of intestinal perfusion are similar.

4232 HEPATIC BILIRUBIN UDP-GLUCURONYLTRANSFERASE IN PATIENTS WITH SICKLE CELL ANEMIA. (Eng.) Maddrey, W. C.; Cukier, J. O.; Maglalang, A. C.; Boitnott, J. K.; Odell, G. B. (Johns Hopkins Hosp., 601 N. Broadway, Baltimore, MD 21205). *Gastroenterology* 74(2, Part 1):193-195; 1978.

To determine the effects of the excessive bilirubin load in sickle cell anemia on the microsomal conjugating enzyme, hepatic bilirubin uridine diphosphate (UDP) glucuronyltransferase, levels of this

enzyme were measured in liver biopsies from 14 patients with sickle cell anemia and 14 control patients with modest elevations in the levels of serum transaminases or alkaline phosphatase, 10 controls who were chronic drug users, 6 patients with Gilbert's syndrome, and 2 patients with hereditary spherocytosis. UDP-glucuronyltransferase activity in the patients with sickle cell anemia was twofold greater ($p<0.005$) than in the 14 nonjaundiced control patients. The elevated UDP-glucuronyltransferase activity in sickle cell anemia was similar to that found in the 10 patients who chronically ingested drugs (barbiturates or estrogens) known to increase UDP-glucuronyltransferase activity. These observations suggest that enhanced conjugation of bilirubin in patients with sickle cell anemia may result from substrate (bilirubin) induction of UDP-glucuronyltransferase.

4233 DAILY URINARY CATECHOLAMINE PROFILE IN MARASMUS AND KWASHIORKOR. (Eng.) Ramirez, A.; Fletes, L.; Mizrahi, L.; Parra, A. (Centro Medico Nacional, Instituto Mexicano del Seguro Social, Mexico City, Mexico). *Am. J. Clin. Nutr.* 31(1):41-45; 1978.

Studies were carried out to determine the daily urinary excretion of catecholamines in normal weight children and in children with protein-calorie malnutrition, as part of a comprehensive study to evaluate the relationships between altered energy metabolism and the hormonal adaptations present in these conditions. In eight normal weight infants (mean age 7.3 months) with gram-positive gastrointestinal or pulmonary infections, 24-hr urine collections were performed on two consecutive days, and triplicate determinations of total catecholamines, dopamine, norepinephrine, epinephrine, and vanilmandelic acid were performed on each urine sample. These results were compared to those obtained in 4 severely marasmic infants (mean age 4.5 months) with moderate hypovolemic shock, 10 severely marasmic infants (mean age 6.4 months) without shock, and 6 children with acute kwashiorkor (mean age 20.6 months). All patients had the same type of infection as the normal weight infants. The day-to-day variability in urinary catecholamine excretion was not significant in any of the groups studied. Marasmic infants and children with kwashiorkor excreted similar amounts of total catecholamines as normal weight infants. However, marasmic and normal weight infants excreted proportionally three to four times less epinephrine than norepinephrine. Children with kwashiorkor excreted similar amounts of the two hormones (epinephrine:norepinephrine ratio=0.88). These findings suggest that in marasmus and kwashiorkor, norepinephrine and epinephrine, resp., are involved in the regulation of the metabolic adaptations to these diseases.

4234 PANCREATIC VEIN CATHETERIZATION WITH GASTRIN ASSAY IN NORMAL PATIENTS AND IN PATIENTS WITH THE ZOLLINGER-ELLISON SYNDROME. (Eng.) Ingemansson, S.; Larsson, L. I.; Lunderquist, A.; Stadil, F. (Dept. Surgery, Univ. Lund, S-221 85 Lund, Sweden). *Am. J. Surg.* 134(5): 558-563; 1977.

Simultaneous catheterization of the aorta and the caval, portal, and pancreatic veins with blood sampling for gastrin radioimmunoassay was performed in three patients with the Zollinger-Ellison (ZE) syndrome and in five control patients without peptic ulcer disease to determine whether these procedures could be carried out in the patients with the ZE syndrome before and after tumor extirpation and total gastrectomy. In addition, the use of high pancreatic arteriovenous gastrin differences for the localization of gastrin-producing tumors was investigated. In the controls, the gastrin concentrations in the pancreatic veins ranged from 15 to 148 pg/ml (mean, 65; median, 67). Pre- and postoperative catheterizations were performed in two of the ZE patients, and very high gastrin concentrations in several pancreatic veins indicated the occurrence of multiple tumors, whereas angiography revealed only one tumor in one of the patients. Twelve months after extirpation of the tumors and total gastrectomy, gastrin concentrations in peripheral as well as pancreatic venous blood were lower ($p<0.001$) but still pathologically high. The third patient was catheterized 2 and 12 months after tumor extirpation and total gastrectomy; the gastrin values were within the range of the reference group (<100 pg/ml) except for one pancreatic vein with slightly increased concentrations. The gastrin concentration did not increase in the interval between the two catheterizations. No complications were noted. The triple catheterization technique with blood sampling for hormone assay is advocated as a diagnostic tool and as a localization procedure in patients with suspected or proved ZE syndrome.

4235 BILE ACID DIARRHEA. (Dut.) Jansen, W.; Rijken, J. (Afdeling Gastro-enterologie van de kliniek voor Inwendige Ziekten, Academisch Ziekenhuis te Groningen, Groningen, Netherlands). *Ned. Tijdschr. Geneeskd.* 121(29):1174-1179; 1977.

4236 GEOGRAPHIC DISTRIBUTION OF GASTROINTESTINAL CANCER IN BELGIUM. UNEQUAL DISTRIBUTION OF THE MORTALITY RATES BY CANCERS OF THE STOMACH AND OF THE RECTUM. (Fre.) Ramioul, L.; Tuyns, A. J. (Ecole de Sante Publique, Universite Libre de Bruxelles, Brussels, Belgium). *Acta Gastroenterol. Belg.* 40(3/4):129-147; 1977.

4237 ROLE OF GUT BACTERIAL FLORA IN NUTRITION AND HEALTH: A REVIEW OF RECENT ADVANCES IN BACTERIOLOGICAL TECHNIQUES, METABOLISM, AND FACTORS AFFECTING FLORA COMPOSITION. (Eng.) Brown, J. P. (Dept. Biological Sciences, Dynapol, Palo Alto, CA). *CRC Crit. Rev. Food Sci. Nutr.* 8(3): 229-336; 1977.

4238 PHAGOCYTE DYSFUNCTION IN COMMON VARIABLE IMMUNE DEFICIENCY. (Eng.) Seger, R.;

Wildfeuer, A.; Auer, I. O.; Jeschke, R.; Catty, D.; Drew, R.; *et al.* (Universitats-Kinderklinik Josef-Schneider Str. 2, D-8700 Wurzburg, W. Germany). *Klin. Wochenschr.* 55(15):735-742; 1977.

4239 ABUSE OF LAXATIVES. (Dut.) Klinkenberg-Knol, E. C.; Tytgat, G. N.; Rutgeers, L. (Wilhelmina Gasthuis, Amsterdam, Netherlands). *Ned. Tijdschr. Geneeskd.* 121(29):1166-1170; 1977.

4240 STUDY OF THE CURATIVE VALUE OF A NEW INTESTINAL ANTISEPTIC IN ALL CASES OF DIARRHEA. (Fre.) Dornier, R. (Groupe de Gastro-enterologie, 127, rue Saint-Dizier, 54000 Nancy, France). *Ann. Gastroenterol. Hepatol.* 13(3):283-286; 1977.

4241 PHOSPHATASE ACTIVITY IN PATIENTS WITH DIFFERENT FORMS OF TYPHOID INFECTION. (Rus.) Bilibin, A. F.; Pogorelskaya, L. V.; Isaeva, N. P.; Morozova, M. M.; Lashin, V. Ya. (N. I. Pirogov Second Moscow Medical Inst., Moscow, USSR). *Sov. Med.* (5):41-43; 1977.

4242 PATHOGENESIS OF FUNCTIONAL INTESTINAL DISORDERS IN PATIENTS WITH ACUTE DYSENTERY. (Rus.) Bunin, K. V.; Fedorov, N. A.; Rybov, V. I.; Malykhina, L. S.; Mescheryakov, V. G. (No affiliation given). *Sov. Med.* (5): 44-47; 1977.

4243 CATAMNESIS IN DYSENTERY PATIENTS. (Rus.) Abubakirov, V. T.; Shalygina, N. B.; Jushchuk, N. D. (Central Scientific Res. Inst. Epidemiology, Ministry Health USSR, Moscow, USSR). *Sov. Med.* (5):47-51; 1977.

4244 MATHEMATICAL METHODS IN THE DIFFERENTIAL DIAGNOSIS OF THE GASTROINTESTINAL FORM OF SALMONELLOSIS AND ACUTE DYSTENTERY. (Rus.) Pokrovsky, V. I.; Mashilov, V. P.; Yushchuk, N. D. (Central Scientific Res. Inst. Epidemiology, Ministry Health USSR, Moscow, USSR). *Sov. Med.* (5):51-54; 1977.

4245 STRUCTURE-FUNCTIONAL ANALYSIS OF THE PATHOLOGICAL PROCESS IN THE STOMACH OF DYSENTERIC PATIENTS. (Rus.) Blyuger, A. F.; Terentieva, L. A.; Sumlyaninova, N. P. (Riga Medical Inst., Riga, USSR). *Sov. Med.* (5):54-60; 1977.

4246 TREATMENT OF THE ZOLLINGER-ELLISON SYNDROME. (Rus.) Zhuravskii, L. S.; Syrbu, I. F.; Chasovskikh, V. M.; Volkov, V. P. (Kalinin Medical Inst., Kalinin, USSR). *Khirurgiia (Mosk.)* (8):6-9; 1977.

4247 RARE SOURCES OF GASTROINTESTINAL HEMORRHAGE. (Rus.) Geshelin, S. A. (Odessa Medical Inst., Odessa, USSR). *Khirurgiia (Mosk.)* (8):12-17; 1977.

4248 QUANTITATIVE CHARACTERISTICS OF IMMUNOCOMPETENT CELLS OF THE LARGE INTESTINE MUCOSA IN ACUTE DYSENTERY. (Rus.) Sinelnikova, M. P.; Novikova, A. V.; Danilova, E. A. (Moscow Scientific Res. Inst. Epidemiology and Microbiology, Ministry Health USSR, Moscow, USSR). *Arkh. Patol.* 39(6):13-18; 1977.

4249 DYNAMIC CHANGES IN THE LYSOZYME CONCENTRATION IN THE BLOOD SERUM OF PATIENTS WITH TYPHOID FEVER TREATED WITH LEVOMYCETIN IN CONJUNCTION WITH PREDNISOLONE AND BUTADION. (Rus.) Martynov, S. V.; Breeva, L. G.; Roenko, N. F. (Ryazan Medical Inst., Ryazan, USSR). *Sov. Med.* (6):127-128; 1977.

4250 WATER AND ELECTROLYTE DISORDERS IN APUDOCARCINOMAS. (Fre.) Grisoli, J.; Nicolino, J.; Serment, G.; Faure, X.; Rampal, P.; Delmont, J. (Hopital de la Conception, 144, rue St. Pierre, F 13385 Marseille Cedex 4, France). *Ann. Endocrinol. (Paris)* 38(2):149-150; 1977.

4251 COMPARATIVE EVALUATION OF COTRIMOXAZOLE AND CHLORAMPHENICOL IN THE TREATMENT OF TYPHOID-PARATYPHOID INFECTIONS: CLINICAL AND BACTERIOLOGICAL STUDY OF 300 CASES. (Ita.) Pastore, G.; Chelotti, P.; Pesce, V.; Schiraldi, G. (Via G. Toma, 34 Bari, Italy). *Clin. Ter.* 81(4):309-324; 1977.

4252 LONG-TERM RESULTS OF RADIATION AND COMBINED TREATMENT OF CYLINDROMA OF THE SALIVARY GLANDS. (Rus.) Brodskaya, N. Ya. (N. A. Semashko Medical Stomatology Inst., Moscow, USSR). *Med. Radiol. (Mosk.)* 22(8):3-7; 1977.

4253 HOMEOSTATIC DISORDERS AND THEIR TREATMENT IN PATIENTS WITH GASTROGENIC TETANY. (Rus.) Spynu, A. V. (Kishinev Medical Inst., Kishinev, USSR). *Vestn. Khir.* 119(8):59-61; 1977.

4254 PATHOGENESIS OF CARDIOVASCULAR DISORDERS IN PATIENTS WITH DYSENTERY. (Rus.) Bychkovsky, V. N.; Vikhreva, E. A.; Bogadelnikov, I. V. (Crimean Medical Inst., Simferopol, USSR). *Vrach. Delo* (6):138-141; 1977.

4255 CLINICAL AND IMMUNODIAGNOSTIC CHARACTERISTICS OF MODERN TYPHUS ABDOMINALIS. (Rus.) Rostapshov, M. F.; Tovstiuk, V. N.; Ushenina, N. S. (Zaporozhye Medical Inst., Zaporozhye, USSR). *Vrach. Delo* (6):135-138; 1977.

4256 LISTERIOSIS IN THE NEWBORN: REPORT OF 53 CASES. (Fre.) Relier, J. P.; Amiel-Tison, C.; Krauel, J.; Helffer, L.; Larroche, J. C.; Minkowski, A. (Hopital Port-Royal, 123, Bd de Port-Royal, F 75014 Paris, France). *J. Gynecol. Obstet. Biol. Reprod. (Paris)* 6(3):367-381; 1977.

4257 ABDOMINAL TUBERCULOSIS IN CHILDHOOD. (Fre.) Hambourg, M.; Harouchi, A.; Revillon, Y.; Nihoul-Fekete, C.; Pellerin, D. (Hopital des Enfants-Malades, 149, rue de Sevres, 75015 Paris, France). *Ann. Chir. Infant. Paris* 18(4):291-298; 1977.

4258 COMPARISON BETWEEN FGPR AND ONE OF ITS COMMERCIAL ASSOCIATIONS WITH ADSORBING SUBSTANCES, FRUCTOSE, AND MINERAL SALTS IN THE TREATMENT OF ACUTE ENTERITIS IN NURSELINGS. (Ita.) Benatti, C.; Galavotti, E. (Sassuolo Hosp., Sassuolo [Modena], Italy). *Minerva Pediatr.* 29(24):1541-1548; 1977.

4259 GASTROINTESTINAL TRACT SARCOMA. (Ger.) Witting, C.; Strunk, E.; Niedorf, H. R. (Pathologisches Institut, Westring 17, D-4400 Munster/Westfalen, W. Germany). *Chirurg* 48(5): 48(5):319-324; 1977.

4260 ACTINIC LESIONS OF THE INTESTINE: STUDY OF 40 CASES. (Fre.) Marti, M. C.; Garcia, J.; Turculet, V. (Hopital Cantonal Universitaire, CH-1211 Geneve 4, Switzerland). *Schweiz. Med. Wochenschr.* 107(15):537-539; 1977.

4261 A NEW APPARATUS FOR DESINFECTION [sic] OF FIBERENDOSCOPES [Abstract]. (Eng.) Baas, E. U. (I. Dept. Medicine, Univ. Mainz, D 6500 Mainz, W. Germany). *Gastroenterology* 72(5, Part 2):1026; 1977.

4262 INTESTINAL MUCOSAL ENZYMES IN THE DIAGNOSIS OF GASTROINTESTINAL METABOLIC DISEASE. (Eng.) Garnica, A. D. (Univ. Florida Coll. Medicine, Gainesville, FL 32610). *Ann. Clin. Lab. Sci.* 7(3):241-250; 1977.

4263 'HEMOCCULT'™ TEST--REVERSAL OF FALSE-NEGATIVE RESULTS DUE TO STORAGE [Abstract]. (Eng.) Wells, H. J.; Pagano, J. F. (Smith Kline Diagnostics, Philadelphia, PA 19101). *Gastroenterology* 72(5, Part 2):1148; 1977.

4264 MAJOR INTESTINAL COMPLICATIONS OF RADIOTHERAPY [Abstract]. (Eng.) Deitel, M.; Alexander, M. A. (St. Joseph's Hosp., Toronto, Ontario, Canada). *Gastroenterology* 72(5, Part 2): 1157; 1977.

4265 DIETARY FIBRE IN PERSPECTIVE [Letter to Editor]. (Eng.) Vickery, K. (Avenue House, Eastbourne BN21 3WY, England). *Lancet* 2 (8034):408; 1977.

4266 DUODENAL GASTRIN CONCENTRATION IN UPPER GASTROINTESTINAL DISORDERS [Abstract]. (Eng.) Hughes, W. (Univ. Texas Medical Branch, Galveston, TX). *Gastroenterology* 72(5, Part 2): 1073; 1977.

4267 SERUM α-FETOPROTEIN CONCENTRATION IN ADULT PATIENTS UNDER CORTICOID, ESTROPROGESTATIVE OR ANDROGEN THERAPY. (Eng.) Chayvialle, J. A. P.; Courpron, P.; Mikaelian, S.; Lambert, R. (INSERM, U 45, Hopital Edouard-Herriot, F-69374 Lyon Cedex 2, France). *Digestion* 15(3):223-226; 1977.

See also, 3481, 3502, 3788, 3799, 3805, 3809, 3812, 3832, 3852, 3872, 3883, 3908, 3916, 3928, 3935, 3936, 3939, 3949, 3991, 4167, 4186, 4277, 4279.

GENERAL

Parasitology

4268 HYDATID DISEASE SCREENING: SANPETE COUNTY, UTAH, 1971-1976. (Eng.) Barbour, A. G.; Everett, J. R.; Andersen, F. L.; Nichols, C. R.; Fukushima, T.; Kagan, I. G. (Univ. Utah Medical Center, Salt Lake City, UT 84132). *Am. J. Trop. Med. Hyg.* 27(1):94-100; 1978.

Between 1971 and 1976, approximately 20% (2,265) of the population of Sanpete County, Utah, was screened for hydatid disease (*Echinococcus granulosus*) by intradermal, indirect hemagglutination and bentonite flocculation tests. In addition, dogs owned by the persons tested were purged with arecoline hydrobromide and the stool mucus was examined for cestodes. Of 34 persons who had follow-up chest radiographs and radioisotope liver scans, 6 were found to have asymptomatic hepatic cysts. If a participant who had pulmonary cysts and negative screening tests was included, the prevalence of asymptomatic hydatid disease would be 3/1,000. During the same period, 82 of 553 dogs successfully purged and examined had *E. granulosus* in-

fections. Human cyst carriage was associated with dog ownership, particularly of infected dogs or in conjunction with sheep raising as the main livelihood. Combinations of immunodiagnostic tests were more efficacious in identifying cyst carriers than the tests used singly. Limitation of screening to high-risk groups (e.g., sheep raisers with dogs) can reduce costs without reducing yield. Optimum management of the cyst carrier awaits further information on the natural history of asymptomatic hydatid disease.

4269 CYTOLOGIC DIAGNOSIS OF ECHINOCOCCOSIS. (Eng.) Garret, M.; Herbsman, H.; Fierst, S. (Downstate Medical Center, Brooklyn, NY 11203). *Acta Cytol. (Baltimore)* 21(4):553-554; 1977.

4270 AMEBIC PERITONITIS. (Eng.) Monga, N. K.; Wig, J. D.; Sood, K. C.; Dutta, D. V.; Kaushik, S. P. (Postgraduate Inst. Medical Education and Res., Chandigarh, India). *Int. Surg.* 62(8):431-432; 1977.

4271 INTRAPERITONEAL RUPTURE OF AMEBIC LIVER ABSCESS. (Eng.) Singh, K. P.; Sreemannarayana, J.; Mehdiratta, K. S. (General Hosp., Pondicherry 605 006, India). *Int. Surg.* 62(8):432-434; 1977.

4272 SEVERE AMEBIASIS IN EARLY INFANCY: A REPORT OF 3 CASES ASSOCIATED WITH HIGH PREVALENCE RATES AMONG FAMILY MEMBERS [Abstract]. (Eng.) Dykes, A. C.; Ruebush, T. K.; Cherry, J. D. (Univ. California at Los Angeles Sch. Medicine, Los Angeles, CA). *Pediatr. Res.* 12(4, Part 2): 423; 1978.

4273 ANERGY AND AMEBIC LIVER ABSCESS. (Eng.) Aguilar-Torres, F. G.; Jackson, L. J.; Rytel, M. W. (8700 W. Wisconsin Ave., Milwaukee, WI 53226). *Wis. Med. J.* 76(10):S124-S125; 1977.

4274 RECTAL BLEEDING DUE TO Oesophagostomum brumpti: REPORT OF A CASE. (Eng.) Leoutsakos, B.; Agnadi, N.; Kolisiatis, S. (23A El. Venizelov Str., Zographou, Athens T623, Greece). *Dis. Colon Rectum* 20(7):632-634; 1977.

4275 INTESTINAL FUNCTION AND MORPHOLOGY IN STRONGYLOIDIASIS. (Eng.) Garcia, F. T.; Sessions, J. T.; Strum, W. B.; Schweistris, E.; Tripathy, K.; Bolanos, O.; *et al.* (Hospital Universitario, Cali, Colombia). *Am. J. Trop. Med. Hyg.* 26 (5, Part 1):859-865; 1977.

4276 INVESTIGATION OF THE SERUM VITAMIN A LEVEL IN ASCARIASIS. (Hun.) Csontos, F.; Varnai, E.; Tihanyi, L.; Gallovich, E.; Simovits, M.; Bekefi, J.; Toth, L. (Baranya megyei Kozegeszsegugyi-Jarvanyugyi Allomas, Pecs, Hungary). *Orv. Hetil.* 119(3):135-136; 1978.

4277 TOXICOLOGICAL AND MEDICAL ASPECTS OF ACUTE BACTERIAL ENTEROPATHY. (Ita.) Donatelli, L. (I Facolta di Medicina e Chirurgia, Universita di Napoli, Naples, Italy). *Clin. Ter.* 81(3):189-211; 1977.

See also, 3722, 3840, 3842, 3845, 3871, 3885.

GENERAL

Regional Enteritis

4278 BILE ACID STUDIES IN UNCOMPLICATED CROHN'S DISEASE. (Eng.) Vantrappen, G.; Ghoos, Y.; Rutgeerts, P.; Janssens, J. (Dept. Medical Res., Univ. Leuven, Leuven, B-3000, Belgium). *Gut* 18(9): 730-735; 1977.

Bile acid composition and pool size were studied in 13 unoperated patients with uncomplicated Crohn's disease (CD), 10 patients with ulcerative colitis (UC), and 10 normal subjects to determine the disorders of bile acid metabolism that are associated with the disease process itself. The bile acid pool size of the CD patients was significantly reduced (1.48 ± 0.16 g) as compared with the normal subjects (3.09 ± 0.27 g, $p<0.001$) and UC patients 2.92 ± 0.40 g, $p<0.01$). A significantly increased ($p<0.02$) amount of ursodeoxycholic acid (6.60 ± 1.93%) was found in the bile of many CD patients as compared with normal subjects (1.39 ± 0.12%) and UC patients (0.72 ± 0.34%). The ratio of glycine to taurine conjugates was greater in Crohn's disease than in normal subjects (5.15 ± 0.39 and 2.35 ± 0.17, resp.; $p<0.001$) or in UC patients (2.22 ± 0.27). Unconjugated bile acids constituted 4.64 ± 1.64% of the pool in CD patients, 2.59 ± 1.17% in normal subjects, and 7.02 ± 2.70% in UC patients.

Both the ESR and the serum cholesterol level correlated with the activity of the disease ($p<0.01$ and $p<0.05$, resp.). However, the parameter that correlated best with the activity index was the bile acid pool size ($p<0.001$): the more active the disease, the smaller the pool size. The latter finding suggests that the intestinal segment in which bile acid absorption is impaired in CD patients is much more extensive than the lesions demonstrated by radiological examinations.

4279 AMYLOIDOSIS AND CROHN'S DISEASE. (Eng.) Fausa, O.; Nygaard, K.; Elgjo, K. (Rikshospitalet, Oslo, Norway). *Scand. J. Gastroenterol.* 12(6):657-662; 1977.

Clinical findings in 7 patients with amyloidosis who were found among 85 patients subjected to intestinal resection for Crohn's disease between 1962 and 1974 are presented. Most patients had symptoms of inflammatory bowel disease of relatively short duration before amyloidosis was diagnosed and were without suppurative complications. Systemic involvement was seen in six patients. One died postoperatively from renal failure, and in two other patients, kidney transplantation was performed because of deterioration of a pre-existent renal insufficiency. Six patients were alive 6 months to 10 yr after amyloidosis was diagnosed. There is great risk of rapid deterioration of kidney function postoperatively in these patients. However, the authors' experiences suggest that in some cases the progression of amyloidosis may be delayed or prevented after surgical treatment of Crohn's disease.

4280 PYODERMA GANGRENOSUM COMPLICATING CROHN'S DISEASE. (Eng.) Korelitz, B. I.; Sommers, S. C. (Dept. Medicine, Lenox Hill Hosp., 100 E. 77th St., New York, NY 10021). *Am. J. Gastroenterol.* 68(2):171-176; 1977.

The 10-yr course of a woman (8-18 yr) with pyoderma gangrenosum complicating Crohn's disease is reported because of its rarity. The development of the skin lesions, their association with the inflammatory bowel disease, and their treatment are discussed. At age 8, the patient had an onset of abdominal cramps, fever, anorexia, and loose nonbloody stools. A barium enema showed narrowing and loss of haustrations in the transverse colon, more marked distally, with eccentric involvement of the circumference and pseudodiverticula formation. At age 11, skin eruptions developed on the extremities, flanks, and groin, characterized by clear drops with red halos suggesting pustules or infected erythema nodosum. At age 15, she had loose stools and recurrent skin lesions, two of which were only 4-5 mm across but looked like pyoderma gangrenosum. At age 18, she had recurrent nausea, chills, and loose stools accompanied by multiple round punched out ulcerations of the skin (1-5 mm in diameter). The patient was always treated with ACTH followed by prednisone plus maintenance therapy with salicylazosulfapyridine. Experience with pyoderma gangrenosum found in the literature is summarized. The treatment of pyoderma gangrenosum is the treatment of the underlying inflammatory bowel disease. High-dose steroid therapy led to remission of the disease, and the salicylazosulfapyridine prevented recurrences.

4281 COLONIC-DUODENAL FISTULA IN CROHN'S DISEASE. (Eng.) Korelitz, B. I. (45 E. 85 St., New York, NY 10028). *Am. J. Dig. Dis.* 22(12): 1040-1048; 1977.

Clinical and radiological findings in four cases of colonic-duodenal fistula complicating Crohn's disease are presented. In three instances, the fistula served as an indication for surgical intervention. After ileosigmoidostomy, ileorectal anastomosis, and ileostomy alone, the patients improved clinically but x-ray evidence of patency of the fistula persisted. Recurrent activity of the Crohn's disease in two patients responded to medical treatment, as it did in one patient without surgery at all. The internal fistula need not be a serious complication of Crohn's disease and should not serve as an indication for surgical correction for its own sake.

4282 CROHN'S DISEASE: STUDY OF 20 CASES. (Spa.) Daza Coronado, A.; Diaz Oller, J.; Dominguez D.-Adame, J.; Donado S. de Leon, J. L.; De Los Santos, D. (Ciudad Sanitaria "Virgen del Rocio," Residencia "Garcia Morato," Seville, Spain). *Rev. Esp. Enferm. Apar. Dig.* 50(2):139-148; 1977.

4283 SYMPOSIUM ON "CROHN'S DISEASE IN GALICIA, SPAIN." (Spa.) Fiol, M.; Ruiz Ochoa, V.; Portela Perez, D.; Gonzalez Abraldes, R.; Potel Lesquereux, J.; Perez Villanueva, J. (Hospital General de Galicia-Santiago, Galicia, Spain). *Rev. Esp. Enferm. Apar. Dig.* 50(4):469-482; 1977.

4284 FREE PERFORATION IN CROHN'S DISEASE [Abstract]. (Eng.) Katz, S.; Katzka, I.; Platt, N. (Long Island Jewish-Hillside Medical Center, New Hyde Park, NY). *Gastroenterology* 72(5, Part 2):1078; 1977.

4285 ZINC DEFICIENCY: A COMPLICATION OF CROHN'S DISEASE [Abstract]. (Eng.) McClain, C. J. (Veterans Admin. Hosp., Minneapolis, MN). *Gastroenterology* 72(5, Part 2):1099; 1977.

See also, 3818, 4021, 4052, 4053, 4056, 4057, 4058.

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